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EDITORIAL NOTES.

The Coal Position—Joint Conference Arranged.

PROMPT steps have been taken, through the Institutions of Gas and Electrical Engineers and the Gas Companies' Protection Association, to bring about a joint meeting on the coal question, in order to press upon the attention of the Government the imperative necessity of immediate measures for securing relief from a crippling situation to the gas and electrical industries, both of which are public services of the first magnitude, and both of which are rendering additional important service to the country to-day. The meeting is to be held on Thursday afternoon at three o'clock at the Institution of Electrical Engineers, Victoria Embankment. To it the President of the Institution of Gas Engineers (Mr. John Bond) heartily invites a representative of every gas undertaking. We hope the speeches made on the occasion will present with full force the gravity of the position, and that the number of representatives attending will demonstrate the seriousness in which the situation, both present and prospective, is held by those responsible for the conduct of the two industries.

Meantime, the Government are showing signs of partial action in connection with the Board of Trade Coal Committee's report. For the purpose of improving the home supply of coal (coalowners, while exporting many million tons of coal during the war, have made deficiency of supply a reason for higher prices at home and non-fulfilment of home contracts), the Committee recommended that exports to all neutral countries should be stopped, but not to our Allies. The Government have now appointed a Committee to exercise control over coal exports during the war. The Chairman is the Right Hon. Russell Rea, M.P., and Sir Douglas Owen and Sir Richard Redmayne are his colleagues. From this Committee, it is understood, ships sailing from our ports, other than liners, will have to obtain licences specifying the quantity of coal that may be exported. We take it that, except to our Allies, the Committee will not allow the exportation of coal while there is any proved deficiency of supply in this country. A further item is that Mr. Runciman in the House the other night pointed out that the rates of freight on interned vessels have been largely reduced. They are still much too high; and the trouble is that, if the freights on the steamers are regulated by the so-called "market rates" (of which we have had some conspicuous examples recently), there is no knowing when there will be more startling flights of the same kind. The President of the Board of Trade did not have anything to say regarding the recommendation of the Committee as to setting up some coal-price regulating machinery, if there was not an early abatement of the views of the coalowners.

Up to the present, there has been no settlement of the question between the coal miners and the owners as to a national 20 per cent. war bonus. The Premier succeeded last week in getting the coalowners to have a conference on the subject with the men's representatives, although the owners still submitted that the already constituted machinery for the settlement of rates of pay should deal with the proposition in each area. Hours and hours have been spent in conference; but, as we anticipated, without any satisfactory result. When the coal miners say that the 20 per cent. only fairly covers the increased cost of living, and that the conditions that have brought this about apply to the whole of the country, so that the payment of the 20 per cent. bonus should be universal, and when the coalowners say that they are prepared to make a general advance of 10 per cent., with liberty to the District Wages Boards to consider any additions which may be warranted by local conditions, and these terms the miners reject, then naturally there is a deadlock, which nothing can set right but arbitration. To arbitration therefore the matter is to go, and Mr. Asquith has been asked by the Miners' Federation to appoint an arbitrator. It may be that the Premier will suggest one for each area; if he does, there may be more dissension.

The "Iron and Coal Trades Review" in its last issue criticizes the critics of coal prices; and the gas industry and the "JOURNAL" are particular marks for its animadversions. But no damage is done. The writer of the article raises his eyebrows with supreme surprise that anyone should think that recent exorbitant prices in the "open" market, and the threatened prospective high ones for contracts, are anything more than figments of imagination, and that such prices as have been charged have not been fully justified. There is either an entire lack of sincerity running through our contemporary's article, or it has been written with an extraordinary amount of ignorance as to what has transpired. It refers to the remarks by chairmen at meetings of gas shareholders as having been made merely for "stage "effect." The author of this cheap sneer does not know much about the character of the men in top places in the gas industry. They are men, too, in intimate touch with the coal industry as buyers. They are constantly being brought into contact with the agents of the coal industry; some of them have their own agents up North in daily touch with all that is going on in the colliery areas. They are frequently brought face to face with the "agreed" increases of price per ton for different qualities of coal; and they know as well as the coalowners themselves that, while there may be a keenness for securing orders, competition is not emphasized by the prices tendered. They know from close and constant experience that there is pretty good cohesion among the owners in holding-out for agreed higher prices. Some of them, too, have recently had to pay dearly for coal in the open market through short deliveries under their contracts; and, in not a few cases, the managements have been able to trace sales of coal, at the high prices ruling in the market, by the very colliery owners or factors who have stated that they have insufficient coal with which to satisfy their contracts and obligations. Such falsehood and malpractice we should not care to have to defend. And the "Iron and Coal Trades Review" says: "The coalowners "desire only to charge fair prices for coal at the present "time. They have no wish to profit by the present crisis." If these statements have a retrospective application, then (excluding certain firms) all it is necessary to say by way of comment is "Nonsense!" If the remarks have application to certain extra pithead prices that have been talked about for new contracts, we can again employ the same laconic comment. If the statements apply to the remainder of the war period, we sincerely hope they are true. The fact of the matter is the coal industry does not like the present activity of some of its exceptionally good and regular customers; and it does not welcome the signs that the Government cannot resist the case for regulation if national interests are to suffer from the acts of those who control, and have the handling of, that which lies at the very root of our general well-being.

The Retiring and the New President.

WITH the deepest regret, it will be learned from the minutes of last week's meeting of the Council of the Institution of Gas Engineers (as published in another column) that, in consequence of the pressure of other important work, Mr. John Bond, of Southport, is unable to continue the tenure of the office of President for a second year. The regret will be—though this is sufficient—not only on account of personal regard for Mr. Bond throughout the gas profession, but because, behind the innate reserve, we all know there exists a store of information derived from individual research and study, and it was confidently expected that, when Mr. Bond occupied the presidential chair at the annual meeting, there would sure to be forthcoming something of special interest to his colleagues. To the pile of grievances against the

war, we have now another to add, in that it has been the means of preventing the realization of anticipations in the foregoing respect. For another reason, we feel sorry for the decision. Mr. Bond has never been a seeker of high office; but his friends, and his unostentatious but valuable work, took him to the place that of free choice he would not have desired. Having arrived there, he has quietly, behind the scenes, performed his presidential duties, and worked effectively for the industry and in a national cause; but, as there will be no annual general meeting of the Institution at which he will preside, we feel, and the feeling will be very widely shared, that there is an absence of completeness about the presidential year, and that Mr. Bond's own professional career has been largely deprived of the distinction which is conferred by the occupancy of the chair at an annual session. However, we must leave it at that, under the double cause for regret. But through Mr. Bond declining the second year's office, we shall have the pleasure of welcoming to the presidency twelve months earlier than was expected another popular figure in the professional ranks—Mr. John Young, of Hull, the present Senior Vice-President. Like Mr. Bond, so far as the portents enable one to judge, he will also be at the head of the Institution in troublous times, and this must mean extra work. We know, however, that, in matters pertaining to the industry, energy and John Young are "synonymous terms," and that, compatible with official duty, the call of the industry will, when he is duly placed in office, find the President there wherever it may be, and for whatever purpose. However, we hope that his year of office, if the event does not occur before (which seems almost beyond the range of possibility), will see the restoration of peace, and the meeting of the profession under happier circumstances than those that now exist, and have prevailed during all but a few weeks of Mr. Bond's year in the presidency.

The Current Position—Electrical Illegalities.

It is impossible, except in our sleeping hours, to forget the war. Its horrors and destruction have their actual scenes elsewhere. Yet war is in the air—we are surrounded by it, our minds desire the latest intelligence obtainable as to its progress, and, with the intelligence, satisfaction rises and falls with an inconstancy typified by the barometrical experiences to which we are accustomed in these Isles. We rise in the morning thinking of the war; we go to bed at night thinking of it. Its effects obsess us during the business hours. We meet with them at every turn—even in Presidential Addresses to technical organizations. We heard of them in the Presidential Address of Mr. W. B. Farquhar, of Ilford, to the Eastern Counties Gas Managers' Association last Thursday; and he concisely summed-up the salient ones that have borne upon the industry. Every gas engineer knows these effects only too well. The less he has experienced them, the more fortunate he may, and no doubt does, account himself. But to-day it is the future, and not the past or immediate present, that is the real matter of concern. The alarm over a possible shortage of mantles has been quelled; and, behind the scenes, work has been going forward which, it is hoped, will make the industry largely independent of Germany and Austria—not only in regard to mantle supply, but in respect of nitrate of thorium. The British gas industry must not again allow itself to become dependent upon Germany for such supplies. Its own positive neglect brought about the position with which it was faced at the beginning of the war; and we hope that what happened then will prove a real awakening.

The coal question, however, as the President observed, is the one of the moment for the industry. There is some satisfaction in knowing that gas supplies have been kept fully going during the war; but, for most undertakings, the satisfaction has over it the pall of an extraordinarily heavy cost, with a future that is absolutely impenetrable. Only those who have made their contracts know approximately what future costs will be; those who have to rely on seaborne coal are not at all confident as to their position. Those who have not made their contracts are altogether uncertain as to the eligible time at which to do so; and the volume and regularity of supplies away in the later months of this year are equally speculative. The President refers to rumours of increases in cost under new contracts of 5s. to 10s. per ton; and he is afraid these figures are likely to materialize into grim realities. What he fears bears upon the division of opinion to which he alludes as existing among gas engineers, as to whether contracts should be entered into at once or later on in the season. If managers are afraid that the figures the President names are going to materialize, and they can enter into contracts now at figures well under the lower one, then there can be no question as to the correct course to pursue. But what are the considerations that give rise to the fear? They are probably no more substantial than are the considerations which suggest that, in view of the report of the Board of Trade Coal Committee, and the pressure of public opinion, the Government will intervene, and apply some regulation to the coalowners' views as to prices. If—and it is an "if" that should be printed in very large capitals indeed—the Government move in this direction, it might be worth while to wait a bit before entering into contracts. The Board of Trade are considering the report of the Coal Committee; and we know that Mr. Runciman has had an interview with representative coalowners on this very subject of future prices. But whether these doings are indicative of any serious move towards the regulation of prices, if there is no immediately resulting amendment, one cannot say. If one could, it would help to determination as to whether or not it was worth while to wait before making contracts. But the whole position is covered by the stumbling-blocks of uncertainty; and, in view of this, no one dares to advise his neighbour (without running great risk of later on bringing on himself anathema for his folly) to buy promptly or else to await the hoped-for better conditions before effecting contracts. There is in the circumstances philosophy in Mr. Farquhar's remark that "it lies with each manager to go "into the market when he considers it prudent to do so, and "then decide for himself according to the quotations he has "received." Accompanying is the momentous question of coal reserves for next winter. Said the President: "I "should certainly advise managers not to deplete their "stocks in any way, but to hold on to them and, if possible, "increase them." We are afraid that in many cases the depletion has already uncomfortable existence; and it will be a matter of immense difficulty to make up the stocks during the summer months, so as to have a large reserve in hand for next winter, which is bound to be one of extreme pressure for supplies. This cannot be avoided with so much leeway to be made up throughout the country; and it will be a case of every man provisioning himself with coal to the best of his power within the limits set by his needs.

The Ilford Gas Company has been one of the most progressive of gas concerns, both in its local work and in the part it has taken in the co-operative operations of the industry. No narrow policy can be attributed to the Chairman of the Board (Mr. William Ashmole) and his colleagues; and certainly not to their Engineer and Manager, who, in dealing in his address with the residuals situation, paid tribute to the valuable work of the Sulphate of Ammonia Association, and, referring to the development of the gas business, to the energetic work of the British Commercial Gas Association. Here we come in contact with one of the unexpected but incidental effects of the war. Some shops in the Ilford district were lighted solely by outside gas-lamps—the light being reflected on to the goods in the windows. A war with Germany, Zeppelin visits, and compulsory lighting restrictions were not contemplated when the method of relying wholly on external lamps for shop-window lighting was introduced. When the "Lights Out" order for these lamps came, then was the opportunity for the Ilford Electricity Department to obtain pickings from the suddenly darkened shops; and it made the best possible use of the opportunity, with the busy time the Gas Company were having owing to a short-handed staff in consequence of the war. The shop lighting the department secured in this way is probably a permanent gain to it; for some of the tradesmen are sure to retain the electric-lamps—not that they will be wanted after the war, but in order to have at command an alternative or supplementary system of lighting. The Gas Company have done wisely, although it means a dead-loss on the investment, in foregoing their rightful claim to at any rate a portion of the charges for the contract lamps; and we hope this will be remembered to their credit in the time to come.

A part of the address, however, which will be read with the utmost interest, and which will be highly valuable to other gas undertakings faced with similar competitive conditions, is that dealing with the recent litigation between the Gas Company and the District Council. The Long Eaton case led the way in giving to the electrical industry

what was very much needed, and that was a sane interpretation of what constituted "undue preference," and a contravention of sections 19 and 20 of the Electric Lighting Act of 1882. In that case, there was the straight-cut issue as to preference being shown to power-*cum*-lighting consumers to the detriment of power consumers who preferred another form of lighting. Mr. George Stevenson told the story of that case in his recent Midland Association paper [see "JOURNAL" for March 16, pp. 640, 659]. The Ilford case brought home to the electricity supply industry that undue preference is prohibited in every branch of a statutory business of this kind, and that preference must not be given under any system of charging, including the assessment *plus* a fixed price per unit method. We believe it would be quite possible to show that a good deal of preferential charging for corresponding supplies does go on in connection with the assessment system of charging. The question has been asked by us before, and an answer has not yet been forthcoming: Why should a man who prefers to do his cooking and heating by some other system than electricity, be compelled to pay more for his lighting units under the assessment method of charging than the man pays for his lighting units who also does cooking and heating by electricity—the lighting requirements being of a corresponding order? We cannot see why the former should pay a higher figure any more than the power consumer who does not light his premises with electricity should pay a higher price for his power units than the power consumer who does use electric lighting. The law says the suppliers of electricity must not differentiate between consumers in this way. The assessment method of charging seems to us to be a distinct aid to an evasion of the restriction imposed by sections 19 and 20 of the 1882 Act.

The action of the Ilford Council, however, in relation to which the Gas Company set the law in motion, was that which conferred in the matter of charging a preference on users of electricity who entirely lighted their premises by this method. There was a second count, which was that the Council were carrying on a fittings, hiring, and other business, and were expending money in these directions, without authorization to do so. The curious thing about this is that the Council themselves appear to have been fully alive to the fact that their operations in this regard were not within the four corners of their statutory powers; for in 1914 they applied to Parliament for the necessary rights to conduct this business. But when Parliament insisted that provision should be inserted in the Bill to ensure the business being self-supporting, the Council objected; and rather than be bound to carry on the business in a business-like way, they withdrew the clauses. The application for powers shows that the Council knew they were setting the law at defiance. And they have been doing so ever since, until the declaration of the Courts, which put an end to the offence. It was, however, the preferential tariff business that set the Gas Company in motion in self-defence; and the Council have only themselves to thank for letting themselves into such a muddle by going to the extreme in unfair competition. The text of the statement of claim and of the declarations of the Court (set out in the address) will be very useful. The President did not comment upon them; and it was not necessary he should do so—the matter being presented in the legal documents very concisely and clearly. For placing these documents in the possession of the industry, the President (and not less his Chairman and Directors) must be heartily thanked. With the Long Eaton Gas Company, they are leaders in this matter of righting what has been a fairly widespread wrong, and of giving legal enlightenment to an industry that, by its actions, admitted it was sitting in the darkness of illegality—and obstinately so.

High-Pressure Gas Lighting for Factories.

THE question of factory lighting was very much in the air before the war. We heard then quite a lot as to the effects of good lighting in the speeding-up of factory output, the improvement in quality, and the safeguarding of the lives and limbs of the workpeople, as well as about the necessity for rational protection of the eyesight of workpeople from the intense light of lamps. Then, too, we were occasionally reminded that there was a Departmental Committee sitting to consider the subject of the lighting of factories and workshops. With the outbreak of war, the Committee suspended their deliberations; and some suppliers of the commodities required for the lighting of factories at the same time concluded that business in this direction—in the way of new lighting, and extensions and improvement of existing lighting—had been for a period completely closed. It is wonderful how prone, in matters of this kind, one is to jump to wrong conclusions. If good lighting can speed-up factories, promote quality of output, and has other valuable virtues, then there has been no time when, in many factories, good lighting has been required more than in the present; for the resources of the manufactories are being strained to their utmost in order to meet the country's needs. There is nothing that the owners are at the present time more pleased to hear about than how to increase the productiveness of their establishments. It may be a bad time while work is at flood-level to alter lighting arrangements; but nevertheless the opportunity is a good one for advancing propositions for so doing. With the rush of work, through national and general demands, many factories are making extensions, or are equipping parts of works that have not been previously put to the most profitable use. In such cases, gas managements should work for the introduction of improved means of illumination; for the introduction will of a surety result in greater things later on.

The district of the Tottenham Light, Heat, and Power Company supplies very favourite ground for factories; and, through the enterprise of the Company, and the dogged determination of the Engineer and Manager (Mr. A. E. Broadberry) not to occupy second place in the lighting of factories, high-pressure gas has obtained quite a large adoption, and, the more it is used, the greater the favour it is winning for itself. Not only from this area but from others, we hear of this favour being exemplified by inquiries being made, without pressure, from managers of works with electricity in use for estimates for high-pressure gas lighting in consequence of what they have seen elsewhere. This is not surprising when they find they can get a steady white light (which the flame arc does not give), and yet a light, powerful as it is, that has not the intense glare about it of the metallic filament lamp, at a cost for illuminating value lower than for electricity. The case of a large firm in the Tottenham district who have had experience of electric lighting in one part of their factory, and who notwithstanding have decided on high-pressure gas lighting for a new section, with the prospect of electric lighting being completely evicted, forms the central feature of a paper that Mr. Broadberry read at the meeting of the Eastern Counties Gas Managers' Association last Thursday. This paper we regard as being a highly valuable one, and believe that it will have a stimulating effect in promoting factory lighting by high-pressure gas throughout the country. But for success, enterprise is wanted, and not the parsimony which tries to effect victory without cost, which latter is not the Tottenham way.

The details of what was done in the case in point (as well as in others) must be gathered from the paper, in which the author has sought to get the gas industry to break-away from the conventionality of speaking of illuminating duty in terms only of the candle power of the source of light, and to state (as should be the case) the foot-candles on the working plane, which is the place where the real value of an illuminant is to be found, and should be tested. We have in the gas industry been too long accustomed to state only the candle power of light sources, without mentioning, under specified conditions, the measured effect of the candle power; and yet we know there is a variation in the diffusion of light from different sources. It is recognized that one can read better at a distance from one form of light than from another, though at the source the candle power may be equal. It is a point to the advantage of gas lighting; and it should not be overlooked in the competition. Mr. Broadberry supplies in his paper data in both ways; and the high foot-candle illumination by the high-pressure gas-lamps puts completely into the shade the low foot-candle results of metallic filament lamps. True the units of light are unequal; but no factory manager in search of good lighting—a manager who knows that quantity and quality are worth money—can fail to give heed to this statement: "Although the total candle power "per foot of floor area is four-and-a-half times as much in "the case of gas lighting as in the case of electric lighting, "the cost of gas lighting is only one-third more than the cost "of electric lighting for a given floor-space." Nor to this: "The cost of 1000 candles of high-pressure gas lighting, as "against 1000 candles of electric lighting is, 0·43d. for high-"pressure gas and 1·56d. for electricity—using metallic fila-"ment lamps." In this case, the electricity is calculated at the low figure for lighting of 1¼d. per unit, being the esti-

mated cost if the firm generated their own electricity by a gas-driven set. Of course, there is agreement with what Mr. J. S. Dow said during the discussion, that in addition to cost consideration has to be given to the question of flexibility, adjustability, and so on. While this is admitted, cost and illuminating value are the paramount considerations. Convenience may be a note on which to play as a trading point, but quality and cost must tell in the long run. And flexibility and adjustability are, as Mr. Broadberry pointed out in his reply to the short discussion, obtainable by special modern gas-fittings. We repeat that the paper has a large value in the competition for factory lighting; for it is based on the best of all recommendations—practical experience.

The Stoke Engineership—A False Step.

In last week's "JOURNAL," there appeared an advertisement inviting applications for the position of Chief Gas Engineer and Manager to the Stoke-on-Trent Corporation, at a commencing salary of £500 per annum, rising to £700, with coal and light free. In this week's advertisement columns, readers will see a special notice, to the effect that the matter of this appointment is under the further consideration of the Council. We advise every gas engineer and manager who is competent to take supreme control of the four works of the Corporation, and the responsibility for the gas supply of Burslem, Stoke, Fenton, and Longton, to immediately withdraw any application he may have sent in, and for all competent engineers to decline to make application for the position, or to renew application, on any terms below those, in every particular, stated in last week's advertisement. The reason for this advice is that there is a section of the members (and that section happens to be in a present majority) of the Town Council of Stoke-on-Trent who think the technically and commercially qualified gas engineer—with capacity to undertake the duties and responsibilities of the management of the four gas-works and the distribution of gas in the four important areas, together with the safeguarding of the large financial interests of the Corporation in the property—is only worth a matter of £400 a year.

The Assessment of Professional Services.

The Gas Committee are not of that opinion; but unfortunately the Chairman (Alderman Mitchell) and his colleagues are in a minority on the Council. The majority have got to be taught by the gas profession that good technical and commercial services in a place of large responsibility are not to be assessed at as low a figure as one of their number—a Mr. Townsend—has chosen to value them at. At the last meeting of the Council, it was first decided that the future gas engineer should not be allowed coal and light free. That is one change in the terms of the advertisement. Then Mr. Townsend protested against the offer of a commencing salary of £500, rising to £700; he being of opinion that they paid "gas managers altogether in excess of their value." Gas managers will be somewhat amused at Mr. Townsend's opinion; and they would be exceedingly pleased if he would show them what qualification he possesses from his past experience for valuing the services of a gas engineer and manager. "Making gas" is not where the duties of a chief engineer and manager begin and end. It is men like Mr. Townsend who bring municipal service into disrepute and contempt among the best qualified men for professional offices, and induce many to try to pass from municipal into company service. We should be sorry indeed to see Stoke-on-Trent, through the dominancy there of narrow minds and parsimony, sneered at and black-booked as a place to be avoided by professional men with self-respect, and possessed with determination to uphold proper remuneration against town councillors of strangely petty ideas. Mr. Townsend's notion of adequate pay for all the work involved by the conditions at Stoke-on-Trent and in the federated boroughs is a commencing salary of £400 a year, without it seems the attachment of other conditions as to the future. We hope the Gas Committee will not recede from their original position, and, further, that they will decline to serve as committeemen, unless the Council authorize them to offer suitable terms to obtain the services of a fully competent chief official.

Some "Horizons" of the Gas Industry.

The title of the paper that Mr. J. G. Clark read before the London and Southern Junior Association last Friday was "Some 'Horizons' of the Gas Industry." The "some" covers the limited illustrations forming the subject-matter of the paper; for if "horizons" is a proper term to apply in the sense that Mr. Clark used it, then there are a good many more "horizons" in the industry than those to which he referred. He confined himself to certain of the "horizons" in the matter of the utilization of gas. But the subsequent part of the paper very properly showed how ill-defined these horizons are; for the author, like ourselves, is evidently well persuaded that it would be very difficult to draw a faithful line representing the limits of achievement in development, or of possible application, and say that is the present "horizon." The "horizon" varies according to local and other conditions. Progress, too, in some particular is ever proceeding to enlarge the horizon of possibility, and encourage to further attainment. Mr. Clark recognizes this by adopting the simile of mountaineering experiences. In no direction in the gas industry has the word "finality" been applied, or even yet been considered; for the gas industry is rich in the lessons of development in efficiencies ever broadening the possibilities of greater realization. But the paper has a good purpose in incentive—incentive to make use of the best of the industry's achievement in the applications of its primary product, and incentive to work to improve this achievement. It is not to the credit of the industry that there is among the consumers such an abundant employment of appliances that are below present maximum efficiencies; and those appliances represent a fearful accumulation of daily waste. An immense amount of work is there for the district staffs of the industry.

The Roads to Higher Efficiencies.

Mr. Clark in connection with lighting appliances shows lines along which it is likely that work will proceed to effect new gains in lighting value from the heat energy of town gas. In the course of this trip into the region of possibilities, he speaks of experiments that he has been making with the intensifying of gas-light by oxygen. In similar work we were much interested thirty years ago; through similar work Lecomte (in his day the the Sugg of the French gas industry) met with his death through an explosion. Big results in efficiency are obtained by the combination; but the old difficulties of complication still stand in the way of any common application. Mr. Clark is something of an idealist. We can do with such in the gas supply industry; for one never knows what practical developments may issue from imagination, which is the real source of invention that is not purely accidental. But it is a very long way indeed to the application of the principles of surface combustion to lighting, as applied in the Bonecourt system to heating. There has been a good deal said of late years regarding the development of artificial daylight; and there is expert evidence that incandescent gas-light requires comparatively little correction through absorption filters. A more handy method than absorption filters coming between the light and the working or inspection plane would, the author suggests, be the use of correcting spectacles. The only objection would be the necessity for different correcting spectacles for every type of lamp. For instance, the spectra of high-pressure and low-pressure gas-lamps are different; so are those of the different forms of arc, metallic filament, and other electric-lamps. It is a good thing the well-constructed gas-heated water-boilers are highly efficient; for otherwise the waste in circulating systems would be fatal to their use. To the end that there may be prevention of part of this waste, Mr. Clark suggests there is useful work to be done. The gas-fire, too, presents its problems in attaining a still higher radiant efficiency from the combustion of a given quantity of gas. But as Mr. Clark points out, what is wanted is not that the radiant efficiency per unit of surface area should be raised to an intolerable degree, but that it should be increased by improved formations of fuel and (we may add) by better distribution over the fuel area. Mr. Clark appears satisfied with the position of the efficiency of the gas-engine; but the research which is going forward, it is hoped, will result in still higher thermal efficiency. A plea for the more scientific rating of gas appliances concluded the interesting paper, which is published elsewhere in this issue.

Benzol Recovery and Fractionating.

Commercially, coal is the absorbing topic of the hour for gas men; technically, benzol extraction from gas has grown rapidly in current interest, owing to toluol requirements for ammunition purposes. It is not, therefore, surprising that to the latter subject there is now frequent contribution from experienced men. One

such is Mr. W. Diamond; and to the North of England Gas Managers' Association he addressed himself last Saturday in a paper which carries one from the *alpha* to the *omega* of benzol recovery and fractionating, without going into all the detail differences introduced by managers of plants. The experience of Mr. Diamond is chiefly with coke-oven working; but this fact in no way detracts from the interest of his contribution to gas-works engineers. In his earlier remarks, Mr. Diamond makes a point which may have escaped the attention of some students of the subject. It is that the benzol content of gas from English coals of comparable quality increases as they go South—that is, the highest content is found in Shropshire and Derbyshire and some South Yorkshire coals. Figures are quoted in the paper in support of this. This, however, in passing. The process of benzol recovery, while quite simple, is one which must be kept well under control, in order to obtain the best results and to avoid losses; and this is where those who are introducing the process will find the paper of considerable guiding use, for we believe that, although gas-works will (so far as can be seen at present) never strip their gas of benzol, the extraction of a portion of it will become a common and permanent part of gas-works operations, for experience is accruing through toluol need which is not at all unfavourable to partial recovery.

Essentials to Good Results.

Among the essentials to good working are that a wash-oil should be used which has great affinity for benzol; and coal tar creosote has large preference. With blast-furnace creosote there is danger of the benzol becoming polluted with paraffin. Maximum efficiency in recovery also requires that the wash-oil should be maintained at as nearly uniform conditions as possible, that the water content of the oil should be kept within 1 per cent., and that the temperature should be right. Temperature plays an important part. The lower the temperature of the wash-oil and the gas, the greater the affinity between the two. This is illustrated by Mr. Diamond in the remark that, when the temperature of the gas is brought down to 60° Fahr., and the wash-oil is reduced to about 32° Fahr., the increase in absorption is about 20 per cent. The paper is largely taken up with a description of recovery and fractionating plant and processes, right to the separation of the final products—including, by the way, an explanation of the washing process for removing from the intermediate benzol the tarry matters and as much sulphur as possible, which is contained in the benzene as thiophene and carbon bisulphide. The keynote to success is complete control by frequent tests, in order to maintain the production of benzol, prevent waste of chemicals, and keep the product as free as possible from impurities. There is also plenty of research work in improving the laboratory tests for the determination of the content of benzol, toluene, &c., in gas.

Calorific Power and Benzol Recovery.

Mr. Diamond incidentally alludes to the stripping of town gas of the benzol content, as did also Mr. W. J. Atkinson Butterfield in the paper he recently read at Cardiff, as published last week. But both authors looked at the matter from different points of view. Mr. Diamond did not make any recommendation, nor refer to the effects from the gas consumers' point of view. Mr. Butterfield did. Of course, the difference in loss of calorific power by extracting benzol will vary according to the coal carbonized, the benzol content, and the efficiency of the absorbent. Naturally, therefore, if 2 gallons of benzol are extracted instead of 3 gallons from gases with, before extraction commences, a like calorific power, the effect upon the calorific value of the gas from which the 2 gallons were taken would be less than that upon the gas from which 3 gallons were removed. With an extraction of 2 gallons, the effect on the calorific value would be a reduction of between 4 and 5 per cent.; of 2·5 gallons, about 7 per cent.; and of 3 gallons, about 8 per cent. Mr. Diamond therefore suggests that, if a gas of about 600 B.Th.U. were produced, the recovery of the benzol would still leave a gas of good quality for use with incandescent gas-burners. But there is the economic side to the question. It costs more to produce a gas of the calorific power named than of the usual calorific power—at any rate, in the case of gas-works southwards; and it would never do to deprive gas altogether of its luminous property when consumed with flat-flame burners. Mr. Butterfield did not suggest going to that extent. He merely advised that those who are extracting toluol from their gas should continue when the war is over to take out about one-third of the benzol, as the gas would then continue to meet the standard of 500 B.Th.U. gross. Benzol is in increasing demand; and there is considerable encouragement in following Mr. Butterfield's advice to this extent. But complete benzol extraction from coal gas is beyond contemplation.

Smoke and Gas.

Smoke is a nuisance which can best be abated by increasing the use of gas for heating and power purposes; and a greater consumption of gas in this way can most readily be secured by selling it at the lowest practicable price. These are facts which have come to be generally recognized; and in Manchester doubtless they are no less appreciated than elsewhere. But has there been a tendency in the city, in these exciting times, to allow them to slip somewhat into the background? The writers of some letters to the local papers are evidently of the opinion that there has; and their view is based upon the announcement that the Gas Committee have, after the matter had been referred back to them for re-consideration, re-affirmed their decision that there should be an increase of 6d. per 1000 cubic feet in the price of gas. Just now, of course, for reasons which are obvious, increases in the price of gas have had to be made in all parts of the country; and the additional charge has usually been accepted by consumers as a burden which circumstances have forced the gas undertakings to impose upon them. But in Manchester the rise of 6d. per 1000 feet in the price is stated to be partly needed to enable the department to continue their contribution of £50,000 in relief of the rates; and this is what is complained of. It is the old argument—strengthened, however, in this particular instance by the fact that there exists a real need to deal with the smoke nuisance. The matter is well put in a letter the main portions of which are reproduced in the news columns of this issue; and another writer subsequently quoted a number of figures to show—what, indeed, those who have studied the question already know—that a rise in the price of gas is not at all the same thing as an increase in the amount per pound levied for rates. Broadly, the allocation of gas profits in aid of the rates may be "taking money from one pocket and putting it in another;" but, unfortunately, it far too frequently happens, as has before been pointed out, that the two pockets do not belong to the same person.

THE SUGGESTED JOINT GAS AND ELECTRICITY CONFERENCE ON THE COAL QUESTION.

Support from the Electrical Press.

In last week's issue, extracts were made from various electrical journals which showed that the suggestion contained in the above headline has their sympathy and support. In addition to the three papers then mentioned, "Electrical Industries" is also thoroughly in favour of the proposal. It says:

> The proposal from Manchester is that a further conference of gas and electrical undertakings throughout the country should be held as speedily as possible. In the view of the Manchester body [Manchester District Institution of Gas Enginers], the matter is a national one and can be effectively dealt with only by calling a national conference in London. We sincerely trust this will be done without delay. As the initiative has come from the public suppliers, there is no need to wait—as is suggested in certain quarters—for the Institution of Electrical Engineers to act. If the Institution possessed an Industrial Committee, representing tramway undertakings and manufacturers as well as electric supply authorities, there would be no question about which electrical body should take the initiative in such a matter. But as the Institution does not possess the machinery for agitation on a commercial question, the duty devolves upon the Incorporated Municipal Electrical Association, which will, we hope, seize the opportunity of useful action, andalso of co-operation with other Electrical Associations. Colliery owners are already quoting heavy prices for next winter's requirements, and the situation demands immediate action on the broadest possible scale.

COAL SUPPLIES CONFERENCE DATE FIXED.

We are advised by the Secretary of the Institution of Gas Engineers (Mr. W. T. Dunn) that the National Conference above referred to, in connection with the serious situation that has developed with regard to coal supplies and prices, will be held on Thursday afternoon of this week, at the Institution of Electrical Engineers, Victoria Embankment. The chair will be taken at 3 o'clock.

PRESENTATION TO MR. THOMAS BOWER.

A DEPUTATION from the staff and employees of the Hartlepool Gas and Water Company last Tuesday waited upon Mr. Thomas Bower, at his residence, for the purpose of presenting him with a token of esteem, on his relinquishing the active management and assuming the position of Consulting Engineer to the Company in the autumn of last year. It was originally intended that the function should take place in January last; but the extra work thrown upon the staff by the bombardment in December necessitated it being held in abeyance for a time. Seven members of the deputation averaged a period of service of more than forty-one years each. The presentation consisted of a solid silver casket, richly gilt, suitably inscribed, and containing a parchment scroll bearing upon it the names of the donors, who comprised all grades in the Company's service, as well as Mr. Bower's past pupils.

Mr. M. G. Burgess (the senior collector), in making the presentation, spoke of Mr. Bower's thirty years' connection with the commercial life of the towns, and said that by his official connection with the Hartlepool Gas and Water Company he had borne his share in the development of the undertaking. Mr. Burgess added that during that period the Company's business had grown from comparatively small dimensions to the large concern that it was to-day. They esteemed Mr. Bower not only on account of their connection with him officially, but also for the interest he had taken in the men, apart from their business relations. In this connection, Mr. Burgess mentioned the formation of a social club and other recreations, and remarked that Mr. Bower did not look upon the employees as mere machines or automata, but as having souls and bodies.

Mr. A. W. Branson (Mr. Bower's successor as Engineer and Manager), Mr. George Mason (Hartlepool), and Mr. J. Swan (chief meter inspector) also offered some remarks.

Mr. Bower, in briefly responding, feelingly and warmly thanked the deputation for the kind token of appreciation they had brought him, which, he said, he would greatly value as a memento of the loyal and faithful service given by the employees as a body. He desired that they would convey his thanks to all who had so heartily shown their appreciation of his services in the past. He claimed the same loyalty and support for those now in charge, and trusted that both the Company and those serving under it would have in the future a happy and prosperous career.

PERSONAL.

At the annual meeting of the Lymington Gas Company, a vote of thanks for his past services was accorded to Mr. JAMES STEVENS, the Secretary, who is retiring.

The marriage took place at Harrogate last Thursday of Miss KATHERINE H. TOWNSLEY to Mr. VICTOR M. ADAMSON. The bride is the third daughter of the late Mr. R. H. Townsley, who was General Manager of the Leeds Gas Department.

Over fifty applications were received for the position of Gas Engineer and Manager to the Nelson Corporation. The short list has now been reduced to three; and a Special Sub-Committee has been appointed to visit the works of these applicants.

On the 15th inst., at St. Agnes Church, Moseley, Birmingham, CLIFFORD BEARDS, M.A., M.R.C.P., D.P.H., son of Mrs. and the late Mr. Paul Beards, of Wolverhampton, married DOROTHY RICHMOND, the elder daughter of Mrs. Richmond, of Moseley, Birmingham, and the late Mr. E. W. T. Richmond.

Mr. CONRAD T. PRICE (son of Mr. Thomas Price), of Walton-on-Thames), who was with Mr. W. E. Price of the Hampton Court Gas Company, and enlisted last August in the 7th East Surrey Regiment, where he attained the rank of Corporal, was on the 23rd ult. gazetted Second Lieutenant in the 3rd Norfolk (Reserve) Battalion.

As mentioned in a paragraph which appears elsewhere, the annual meeting of the Society of Chemical Industry will be held in Manchester from the 14th to the 16th of July; and it is announced that Mr. CHARLES CARPENTER, D.Sc., one of the Vice-Presidents, has been nominated by the Council for the presidency in the ensuing year.

OBITUARY.

The death has recently occurred of Mr. JAMES SEARLE, who was Clerk and General Manager of the New River Company. Deceased was in receipt of a pension of £1407 per annum from the Metropolitan Water Board.

Deep sympathy will be felt with Mr. JAMES R. DUFF, the Secretary and Manager to the Banbury Gas Company, in the loss he has sustained through the death of his wife, which took place on Monday afternoon of last week.

The death has occurred at Smethwick of Mr. J. J. HORTON, proprietor of a successful gasholder building business in the town. He was 76 years of age. The business, which he subsequently controlled with his brother, was established by his father.

Second Lieutenant ERASMUS DARWIN, a grandson of Charles Darwin, the famous scientist, has just been killed in the fighting in France. He was the only son of Mr. and Mrs. Horace Darwin, of Cambridge, and belonged to the 4th Battalion of the Yorkshire Regiment. Born in 1880, he was educated at Marlborough and Cambridge. After working for some time at Messrs. Mather and Platt's, in Manchester, he entered the service of Messrs. Bolckow, Vaughan, and Co., of Middlesbrough, and occupied a very important position when the war broke out. He was a Director of the Cambridge Scientific Instrument Company.

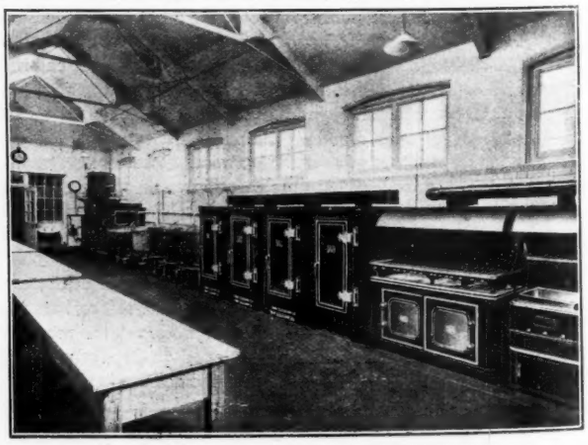
In the "JOURNAL" for the 9th of March (p. 575), we noticed the completion of his hundredth year by Mr. JOHN ROBERT DURANT, who was for forty years in the service of the South Metropolitan Gas Company; and a few particulars of his life-work, from the Company's "Co-Partnership Journal," were given. He retired on a pension in March, 1883, and lived in a cottage at Weybridge, where he has just died. He was not only the Company's oldest pensioner, but also the oldest National Reservist. He joined the Royal Navy when he was fourteen, served in the West Indies, and was wounded in one of the Spanish insurrections. It may be remembered that the King sent him a congratulatory message on the anniversary of his hundredth birthday.

The news has been received of the death in action at Neuve Chapelle of Lance-Corporal ALBERT H. HARRISON, eldest son of Mr. H. G. Harrison, Gas Manager to the Ashbourne Urban District Council, and formerly of Droitwich. After leaving school at Ashbourne, Lance-Corporal Harrison became a member of the Notts and Derby Territorials, who, on the outbreak of war, were merged into the Sherwood Foresters. Last July he was appointed Assistant Manager at the Farnham Gas-Works. He was a great-grandson of the late Mr. W. Harris (who was for more than forty years Gas Manager at Droitwich), and was related to, among others in the gas profession, Mr. J. A. Harris, of Wigston, Mr. A. T. Harris, of Market Harborough, Mr. A. J. Harrison, of Padiham, and Mr. A. J. Harrison, of Brigg.

SIXTY YEARS AGO.

From the "Journal" of May, 1855.

The Beginnings of Gas Lighting.—It is interesting and instructive to look back to the beginnings of an important invention, to mark the difficulties through which it successfully struggled, and note how it was elaborated from a cloud of errors and speculative fancies, and reduced to a great practically operating fact. Nor does any invention present a more striking illustration of the modification of originally wild notions into useful development, by time and experience, than that of gas lighting. We have recently had occasion to ridicule the golden visions of peat and electric gas projectors, and we have endeavoured to show that the stores of wealth which they unfold to view have only a phantasmagoric perspective; but, brilliant and illusory as those visions may seem, they are but dim compared with the magnificent prospect of coal-gas illumination which dazzled the sight of one of its earliest projectors. The utmost that peat gas proffers is to supply gas of superior quality for nothing, and to pay dividends of some 20 or 30 per cent. out of the profits; but the National Light and Heat Company, projected by Mr. Winsor in 1808, promised an annual interest of £570 for every £5 deposit. And this, too—by his own showing, at least—based on such moderate computations that there seemed greater probability of the dividend being doubled than that it should have been one farthing less.



A photograph of an installation of special cooking apparatus, comprising "Rostrum" ovens, "Inca" hot closets, and "Friar" fish-fryers, which has recently been fitted-up by Messrs. John Wright and Co., of Birmingham, at the Norfolk County Asylum, Thorpe, near Norwich.

INSTITUTION OF GAS ENGINEERS.

Council Meeting.

A MEETING of the Council of the Institution was held at the Offices, No. 39, Victoria Street, Westminster, on Monday of last week—the PRESIDENT (Mr. John Bond, of Southport), in the chair.

COMMUNICATIONS REPORTED.

The following communications were reported: From the Board of Trade, stating that the Board were unable to hold out any expectation of financial assistance being granted by the Government in aid of statutory gas undertakings requiring to extend their undertakings. From the delegates attending the deputation to Mr. Runciman on the question of coal supplies, stating that the Board of Trade appreciated the seriousness of the situation, and would do everything within their power to overcome the difficulties which had been pointed out. From the Vice-Chancellor of the University of Leeds, expressing the gratification of the Senate that the Institution had decided to connect the Corbet Woodall Scholarship with the University. From Sir Corbet Woodall, acknowledging the message of congratulation from the Institution to Lady Woodall and himself, which had been sent on the occasion of their Golden Wedding.

DISTRICT MEMBERS OF COUNCIL.

It was reported that Mr. Walter Watmough and Mr. W. J. Rendell Baker had been re-elected as district members of Council representing the Manchester District Institution of Gas Engineers and the Midland Association of Gas Engineers and Managers respectively.

MEDALS FOR LAST YEAR'S PAPERS.

Medals for papers read at last year's meeting of the Institution were awarded as follows: The Institution Gold Medal to Mr. Jacques Abady, for his paper on "Calorific Power as a Standard;" the Silver Medal to Mr. John West, for his paper on "Lime and Sulphate of Ammonia as Fertilizers, and How to Increase their Sale;" the Bronze Medal to Mr. B. Schieldrop (of Bergen), for his paper on "Some Special Features in Gas-Works Practice from Norway." The "London" Gold Medal was awarded to Mr. G. T. Purves, for his paper on the "Application of Coke-Oven Carbonizing and 'Otto' Direct Ammonia Recovery to Gas-Works Requirements."

APPLICATIONS FOR MEMBERSHIP.

Applications for membership were considered, and the following names were approved for insertion in the next ballot list: As candidates for the class of member—Mr. William Ernest Dean, of Exmouth; Mr. John Harry Donaldson, of Sevenoaks; Mr. Edgar Foster, of North Sydney (N.S.W.); Mr. Frederic George Gorman, of Lower Sydenham; Mr. William John Pritchard, of Blaenau Festiniog; Mr. Ernest Sainter, of Houghton-le-Spring; and Mr. Albert James White, of Chard. For the class of associate member—Mr. Percival Joseph Channon. Mr. Timothy Thornton, of Rowley Regis, was transferred to the class of member; and Mr. Francis W. J. Belton was admitted as a student.

DEATHS.

The deceases of the following were announced, and a resolution of condolence with the bereaved was passed: Mr. William Blair, of Helensburgh; Mr. John Carter, of Lincoln; Mr. William Davis, of Poole; Mr. William Fergusson, of Barrow-in-Furness; Mr. William Langford, of Stoke-on-Trent (members); and Mr. W. H. Owen, of Hornsey (associate member).

COAL SUPPLIES AND PRICES.

Questions in connection with the serious situation which has developed in regard to coal supplies and prices were discussed; and it was decided to hold a conference at an early date, in conjunction with the electrical industry and the Gas Companies' Protection Association, for the purpose of considering the best course to adopt for bringing the far-reaching issues involved to the attention of the Government, with a view to some immediate measures of relief being obtained.

ANNUAL BUSINESS MEETING AND THE PRESIDENCY.

The Finance Committee presented their report, which was accepted and adopted.

Arrangements for the annual business meeting in London on June 1 were discussed.

With regard to the position of President for 1915-16, Mr. Bond announced that, in consequence of the pressure of other important work, he would be unable to accept office for a second year, as proposed by the Council. A resolution was passed expressing the Council's regret, and their appreciation of the services Mr. Bond was rendering at the present time. Mr. John Young, of Hull, was nominated for election as his successor.

Benzol Recovery in America.—The erection of plants for the recovery of benzol is extending in the United States; the North-Western Iron Company of Milwaukee having built a plant at Maysville (Wis.) which is expected to be put into operation almost immediately. The Laclede Gas Company of St. Louis also are about to construct apparatus for the manufacture of benzol; the prospective annual output being estimated at 300,000 gallons.

NOTES FROM WESTMINSTER.

THERE is little enthusiasm to be found in the Parliamentary Committee rooms; and there is a general dreariness about them and the corridors through the small demand that is being made upon them this session. The number of "unemployed" in the professional ranks at Westminster has, with all the slackness of recent years, never been so high as now; and those who have been retained in connection with some Bills have this session more leisure time than coincides with their views. There are only two or three matters that require mention this week.

End of the Yorkshire Power Company's Scheme.

Lord Hylton's Committee have decided that the Yorkshire Electric Power Company cannot be granted preferential statutory powers in respect of the supply of electricity for lighting in 64 urban districts, 13 rural districts, and parts of other rural districts. The clauses of the Company's Bill dealing with this matter were consequently deleted by the Committee; and the Company thereupon decided that the measure without these vital parts was useless to them, and so abandoned it. We congratulate the gas companies and the local authorities who opposed the measure. The case submitted to the Committee by them, supported by the Board of Trade report on the subject, put the promoters completely out of Court. Reference was made to the contest in the "Notes" last week; and the lines of objection to the scheme were then sketched. It would have been totally unfair if the Company had had conferred upon them powers to monopolize for electric lighting purposes all unoccupied districts in their area that were worth taking, and so seal-up the natural outlets for extension by existing suppliers. It would also have been grossly unfair to their gas competitors if the Company had had powers given them which did not include the ordinary obligations of electricity suppliers. There was submission on the part of the Company that section 49 of their Act of 1901 provided for purchase if desired by local authorities; but this power, under the Company's conditions, is totally inadequate. It seems reasonable to think with the Board of Trade that those local authorities who gave their support to the Bill, and were proposing to put themselves under the uncontrolled grip of the Company—uncontrolled so far as general electric lighting powers are concerned—had not cognizance of the full import of the scheme.

Repayment Periods.

The Local Government Board are doing their best to make the purchase of trading undertakings less attractive to local bodies; and if it has this effect, well and good. But there is the question of the consumers to consider. If repayment periods are reduced below the life of the plant, naturally this means a greater burden on present consumers. The Board, too, are not at all favourable to the periods of repayment for loans being fixed by Parliamentary Committees; but the only objection to the latter deciding the periods is that the result shows anything but uniformity of practice—uniformity subject to special and local conditions. The Chelmsford Corporation Gas Purchase Bill was before the Unopposed Bills Committee last week; and the Local Government Board reported against the repayment periods desired by the Corporation, and suggested that the matter should be left to the decision of the Board. The periods asked for were 35 years for the liquidation of the purchase loan, 40 years for new plant, 30 years for mains, and 20 years for stoves, meters, and fittings. The Committee investigated the matter, with Mr. William Newbigging in the witness chair, and gave the Corporation the periods desired, except that referring to stoves, meters, and fittings, which was reduced to 15 years. The same point was made by the Irish Local Government Board regarding the repayment periods (save in respect of the 40 years for the purchase money, which is five years more than was objected to in the case of Chelmsford) in the Lurgan Gas Purchase Bill; but they did not press the matter of leaving the fixing of the periods to them, seeing that the Bill incorporates a detailed estimate. The Local Legislation Committee, after hearing Mr. Frank Jones on this and other points, passed the sections of the measure referring to the gas undertaking, including all the financial proposals. The Lurgan Bill is one of those in which appears the no-margin 500 B.Th.U. (total heat) calorific clause.

South Staffordshire and Wolverhampton Water Bills.

After a wearying expenditure of time (mainly through the opposition of landowners) the Duke of Wellington's Committee have concluded their consideration of, and have given their decision upon, the Bills promoted by the South Staffordshire Water-Works Company and the Wolverhampton Corporation, which were to an extent competitive in respect of new water powers and additional territory. The Committee were in a sense arbitrators. There was something favourable to be said for the schemes of both promoters; and the Committee have acted judicially between them, and allocated to them what, after the long deliberation, they consider fair. The matter is so succinctly summed up in our "Parliamentary Intelligence," that readers who may be looking for the gist of the proceedings in these "Notes" may be referred to the report.

ELECTRICITY SUPPLY MEMORANDA.

Changes.

After the war, what is going to happen in regard to shop lighting? Will jumping flame arc lamps again appear outside shops, unshielded, and annoying the eyes of pedestrians, or will one effect of the war lighting regulations, and present experience of lower lighting accounts, be to moderate the ideas of tradesmen in the matter of lighting? It will not be surprising to find this is so. To this opinion one is led by the experiences in some of the shopping areas where electric-lamps have had considerable vogue for both outside and inside lighting. The complete extinction of the outside lights, with the hideous fittings remaining on view, and the coloured paper-shaded lamps inside the windows, have not been in conformity with æsthetic notions; and electrical contractors have consequently been reaping a fairly rich harvest in the conversion of exposed metallic filament lamps of high intrinsic brilliancy to concealed lighting, or in incarcerating them in indirect or semi-indirect fittings. "It's an ill wind that blows nobody good." In this case, the war regulations have produced work for the electrical contractors, and simultaneously have relieved the public from the eye-tormenting forms of electric-lamps by compelling more scientific methods. Another change that is being fast brought about owing to the scarcity and high cost of carbons, is the supersession of flame arc lamps by three-quarter watt lamps—commonly and mistakenly known as "half-watt" lamps. But there has to be great care in installing them in properly constructed enclosures, in view of the necessity of good ventilation, and yet protection from the weather, owing to their high temperature. They are also being adopted in places for inside shop lighting with indirect or semi-indirect fittings. There are rumours afloat that (to use the ordinary name) "half-watt" lamps of much lower candle power have been seen on the Continent, even for high voltages—for instance, 200-candle power lamps, which, the credulous informant believes, have this power, and only take 100 watts per hour. These lamps have not been seen in this country; the ascribed reason for the mystery being that interested people—those with large stocks of ordinary metallic filament lamps to dispose of—are for a time keeping the new ones at arm's length. Thinks anyone that such a tale will hold water? Some way would be found by dealers to get the lamps here. The British Thomson-Houston Company are advertising 150-watt lamps, which, as they are described as "half-watt" ones, mean 300-candle power; but the Company do not expressly say they really give such a good account of themselves. These lamps, however, can only be used on voltages of 50-60 and 100-130; so that, on most circuits in this country, they would have to be used in series. The Company are also advertising a 300-watt lamp for 200-255 voltages, which (if the description of "half watt" were true) should give 600-candle power. We do not think the makers would care to guarantee the 600-candle power. It is noticed that the Osram people have renamed their "half-watt" lamps; and henceforth they will be known as the Osram "Atmos" lamps, presumably because the bulbs are filled with an inert gas.

First Cost and Maintenance.

No excuse is needed for returning to the discussions that have taken place in different parts of England on the paper Mr. W. R. Cooper read before the Institution of Electrical Engineers in London. The last one was by the Yorkshire Section. Looking over this and the previous discussions, it is seen how, in all quarters of the country, experiences are alike in connection with the use of electricity for cooking and for water heating. The experiences in Yorkshire are the same as those in Lancashire, the Midlands, and in London. People are indisposed to buy electric-cookers, because they regard such a transaction very much like "buying a pig in a poke." They are profiting by the vagarious experiences of other people; and these experiences make them shy. Mr. Campion, at the Yorkshire Section meeting, said that Dewsbury have in it some wealthy men; but they will not risk even £12 10s. on an electric-cooker, although they would not mind hiring one. Hiring rates, however, must include not only the expense of installation and the cost of the cooker, but maintenance; and the life of the cooker, and the cost of its maintenance, must follow the extent of use and the quality of the assaults to which it is exposed. A fair margin must therefore be allowed. Points of possible defect in an electric-cooker are many compared with a gas-cooker. What electric-cooker manufacturers think of the cost of maintenance is well disclosed by Mr. Campion. He stated that a consumer had obtained the following contract for maintenance from the makers of a purchased cooker: First year, free; second year, 8s. 6d. per quarter, or £1 14s. for the year; and third, fourth, and fifth years, 17s. 6d. per quarter, or £3 10s. for the year. This reveals something as to life. *After paying for his cooker*, maintenance is to cost this user £12 4s. in five years, without the expenditure for electric energy! Yet certain brazen-faced electricians talk of electric cooking being as cheap as gas! In the third, fourth, and fifth years, this person who so lightly parts with his money might, for what he is paying for electric-cooker maintenance alone, purchase annually a new gas-cooker, and make a present to his friends of the barely damaged ones. A Mr. Collinson, who is an electrical contractor, stated that an electric-cooker cost at least three times as much as a gas-cooker; and for a house of only £20 to £25 rental, he would have to make a hiring charge of £3 a year! A gas-cooker of the same size could be locally hired for 10s. a year. Therefore, though it is electrically claimed that the one thing needed to make electric-cookers highly popular is the power of hiring, it is clear that hiring rates cannot possibly be brought down to the level of those for gas-cookers. The manufacturers were, of course, blamed for the cost of electric-cookers, and not their organism, which is far more delicate and expensive than that of a gas-cooker. Very close attention has to be paid to details in building an electric-cooker; and the manufacturer has not yet been born who can make serviceable electric-cookers at the same price as gas-cookers, and guarantee that the maintenance shall not be higher.

Water Heating and Hot-Plates.

The same with water heating. There has been little bonanza for the electricians in this direction; and hopefulness is a diminishing quantity. What puzzles us is why some men should devote so much consideration to this matter when water heating by electricity is altogether outstripped in economy—money and time—by other methods of water heating. Perhaps they are cynical enough to believe that there are sufficient fools among householders to make a paying branch of business even out of water heating. Of course, they are not all of this way of thinking. One speaker—Mr. Innes—at the Yorkshire Section meeting, expressed the opinion that electrical engineers would not get many people to go in for water heating although the price of current was as low as ½d. per unit. Even water for tea and similar requirements, he added, consumed a good deal of the total electrical energy supplied to any house. Of course, as Mr. T. Roles pointed out, one can save time by using a large amount of current for heating water as it leaves the tap; but what about the comparative cost, and the technical question as to the effect upon the pressure in the electric-supply mains? On the latter point, Mr. Roles does not think the effect is so great as is generally anticipated—provided fairly large mains are in existence. Large mains to meet a demand of this low-priced and erratic kind would mean additional expenditure which could not be justified. Arising out of this question of water heating, it will be remembered that at length electricians have discovered, and now acknowledge, that 60 to 70 per cent. of the work in cooking is done not in the oven but on the hot-plates, and that these are the most inefficient and troublesome things in connection with electrical kitchen equipment. Mr. H. Purle, it will also be remembered, wrote to the "Electrical Times," favouring the use of self-contained heating utensils, instead of hot-plates. Among the criticism that he met with was that the efficiency of hot-plates can be increased either by greater loading or else by using exposed wire operating at a red heat. He now writes to our contemporary to say that he fails to see this. As more heat will be lost by convection and radiation, with increase of temperature, in proportion to the amount generated, he imagines the efficiency must fall. So say other people. Also, raising the temperature must increase the strain upon the insulation, with consequent greater liability to breakdown. The use, too, of exposed heating wire is open to many objections. Apart from liability to accidental shorts and shocks, a considerable air-space must be left between the heater and the utensil. Thus, when working at a reduced loading, for simmering, &c., the wire ceases to be red hot, and all heat must be transmitted by air convection at a consequent low efficiency. What, he pertinently asks, is the use of selling electricity at ½d. per unit and then giving the consumer apparatus which uses twice or three times as much current as is necessary? While admitting that the first cost of self-contained heating utensils is at present high, he omits to mention the inconvenience to users, if they relied solely upon such electrical appliances, of being deprived of their service while away undergoing repair at the makers or the electrical contractors. We have not yet come across users of this class of appliances who have such faith in them that they abandon all other means of effecting the same work.

A Diplomatic Move.

The London County Council are not proposing to have their electricity supply scheme shelved any longer than is absolutely necessary. They cannot make a parliamentary move just now, so they are taking a wise course. They have determined to do now what they should have done some time since, before they issued the cut-and-dried scheme which they wanted to force through Parliament and down the throats of everybody concerned. They have decided to have a conference with the county and borough councils and the electricity supply companies in the extensive area they mapped out for annexation under their scheme; and the bodies interested are appointing representatives to attend the conference. But, of course, the delegates will not be in a position to commit the public bodies or companies they represent; and after what transpired when preparations for the contest were being made this session, it is abundantly clear that a scheme on anything like the lines of that originally proposed will still meet with very bitter resistance with a view to its overthrow. It is not likely the present undertakings will be prepared either to be swallowed holus-bolus, or to have their existing plant sterilized in the matter of productive economy, by being compelled to become patrons for additional supplies of the huge stations the County Council are proposing. The County Councils outside the Administrative County of London are asking themselves why, if

there is really anything in this extensive amalgamation of supplies and concentration of generating plant (which is very doubtful when the figures put forward are studied in comparison with the working of some of the present stations), they should not have separate amalgamations and concentrations outside London, and let London "go on its own?" Ten London companies, it will be remembered, also proposed a scheme for the current session, which Parliament asked them to defer to a more convenient season. Naturally, the London County Council do not like the look of this schismatic work.

Struggling for Separate Existence.

The Electric Supply Publicity Committee has not been much heard of lately. It is an organization that has had a chequered career, and has not found much favour in the eyes of the electricity supply industry. In its early days it succeeded in alienating the sympathy, and in causing the withdrawal, of some of its best supporters—partly by its childish and slanderous attacks on the gas industry, which threatened to bring certain of the ignorant adopters of the Committee's style and statements into the Law Courts at the instance of local gas concerns. The Committee's undiplomatic work was a cause, added to the larger causes of educational work and general publicity, of the birth of the now effectively operating British Commercial Gas Association. Those who were responsible for some of the libellous statements regarding gas that obtained circulation in those early days of the Electric Publicity Committee, ought to be able to find lucrative employment to-day in the publicity department of the German Government. But after its original unfruitful activity, the Committee, through the withdrawal of much support, had to settle down to an existence which has barely kept alive the name, and yet the surviving members refuse to put an end to the existence of the struggling affair. There is now some talk (so we gather from "Electrical Industries") of the organization making an effort to resume a more active life. The stimulating circumstance seems to be the formation of the Development Committee by the Incorporated Municipal Electrical Association. But our contemporary seems to think the Publicity Committee would gain more credit by readiness to sink its individuality and to co-operate with the larger Committee. "Unity," it adds, "in such a situation means economy, which is of vital importance at the present time; and undertakings which have the choice of galvanizing a moribund local committee or of sharing in an energetic campaign upon the broadest possible basis, are not likely to discover much difficulty in coming to a decision. The electrical industry has to deal with the publicity operations of a rival which enjoys an annual revenue of between £10,000 and £15,000. In such circumstances it is nothing more than common sense to close the ranks."

Prices under War Conditions.

Some administrators of electricity concerns are still much exercised as to whether or not they ought to increase the charges for electric current. The question is really quite a simple one. If companies can pay their way under current circumstances with existing prices, without dragging their reserve funds too low (if they have any), then it is a position for which they should be thankful, and to which they should adhere as long as possible. If municipal authorities can continue to make both ends meet with their pre-war charges without applying to the ratepayers for support, then it is their duty to do so. Most of the London Electric Supply Companies have now decided to add 10 per cent. to all accounts for current—this being regarded as the simplest and most equitable plan under the various tariffs obtaining in each concern. It is reiterated by the companies that the additional 10 per cent. is less than the increases made to users of gas. This is a matter attention was directed to in the "Memoranda" three weeks ago, p. 68; and it was then seen that the percentage point of view is not the only one to take. The Notting Hill Company have increased their price from 5d. to 5½d. Among the Metropolitan Borough Councils, there is a difference of opinion as to the course to pursue. The Electricity Committee of St. Pancras were recently urged to advance their charges by 10 per cent.; but the Committee replied that it was their policy to reduce, and not to raise, them. A very good policy too, providing that it can, in these times, be pursued without forcing the ratepayers to render pecuniary aid to the undertaking. The Marylebone Electricity Committee, on the other hand, are going to increase their rates by 10 per cent.; the reason adduced being that it is expected there will in the near future be a considerable diminution in the lighting demand. The reduction in the income of the Department in the December quarter was £6378; while the expenditure was only £1032 less. The Committee, in their estimates for the current year, are allowing for an advance of 33 per cent. on the price of coal. This, on an estimated sale of 16½ million units, will involve an extra charge of £6525. Then special charges arising out of the national crisis will require £12,000 this year. It looks as though the 10 per cent. extra will be wanted by the Marylebone Committee, though they are, it is understood, being paid the full charge for public lighting by electricity. The Newport (Mon.) Electricity Committee have increased their charges by 20 per cent. on all classes of consumption. At Richmond, the advance is to be 10 per cent. The Maidstone Corporation have resolved upon an increase of ⅛d. per unit for lighting and heating, and ¼d. for power.

COKING AND BYE-PRODUCTS.

By "Event and Comment."

Sulphuric Acid.

For some months past there has been considerable difficulty in obtaining supplies of sulphuric acid for use in connection with sulphate plants on coke-ovens. The scarcity of acid is undoubtedly due to the fact that extraordinarily large amounts are being used in steel works, wire works, for explosive manufacture, &c. In consequence, the price has risen very considerably, and the writer heard of a contract made last week (only after some difficulty) at a price of 85s. per ton delivered. Of course, the raw materials necessary for the manufacture of the acid have also correspondingly increased in price. Much of the raw sulphur is imported, and the high freights have restricted trade in this direction. There has, therefore, been a brisk demand for spent oxide, and the price of it has increased by some 50 per cent. Sulphate makers, and particularly those who have not contracted ahead for supplies, are feeling very anxious with regard to the future. There does not appear to be any immediate prospect of improvement; and as several new plants are nearing completion, the demand for acid will increase rather than decrease.

The writer gathers that some ammonia producers are considering the advisability of altogether dropping sulphate manufacture for the time being, and putting in its place plant for making strong ammonia or concentrated gas liquor. At first sight this latter proposition appears to have many advantages, as calculating on ammonia values, and on present prices of acid, labour, &c., it can easily be shown that the manufacture of strong ammonia is more profitable. There are, however, many objections to it, and the most important of these is that the demand is limited. Strong ammonia is used principally for certain trade purposes; and if the supply is increased to any extent, the price will certainly fall, and then the profit is such that sulphate making will pay better. Then, too, the trade in strong ammonia is almost entirely in the hands of one or two large firms, who, if necessary, could easily squeeze out a smaller and less powerful competitor. In the writer's opinion, even with acid at 80s. per ton, sulphate making is by far the safer proposition. That the scarcity of sulphuric acid is becoming acute and fairly general is confirmed by the fact that a Sub-Committee is being appointed by the Government to inquire into the position and to assist those firms who are doing Government work to obtain supplies.

It is not unlikely that one result of the scarcity will be to encourage the owners of large coke-oven plants to put down their own sulphuric acid plants, and, moreover, to supply their own sulphur requirements largely, if not entirely, by purifying their gas from sulphuretted hydrogen by means of oxide of iron. Such a situation as the present one is a very serious matter for coke-oven people, because sulphate of ammonia is responsible for a large share of the revenue of a bye-product coking plant; and in the event of a sudden shortage of acid the ammonia is lost, as, in the majority of cases, one or other of the direct recovery processes being employed, there is no provision for accumulation of ammonia in the form of liquor. Even if the proposition of building their own sulphuric acid plant is not sufficiently attractive, it should be possible to enter into some arrangement with the makers whereby the sulphur was recovered from the coke-oven gas and the spent oxide sold to the acid makers. A sliding-scale arrangement, according to the ruling price of sulphuric acid, could easily be devised whereby the coke-oven people would be assured of a supply of acid as long as they produced sulphur, and hence as long as the ovens were working. Only at such times, of course, would acid be required.

Coke-Oven Plants.

Quite a number of coke-oven plants in the country are nearing completion, and have been in this state for a considerable time, and (what is more) appear to be likely to remain uncompleted for some time yet. The reasons for non-completion are various. In some cases it is due to materials, bricks, machinery, &c., which have been ordered abroad not now being available. In other cases, the materials have been ordered in this country, but the firms with whom the orders have been placed are so busy with "urgent Government work" that they are unable to execute the coke-oven orders placed with them. In one or two instances the circumstances are particularly unfortunate, as the whole of the work is being held-up for the sake of some comparatively small things. Again, some firms are undoubtedly taking advantage of the stress of Government work; and the writer is afraid that the excuse that "We are engaged on most urgent Government work" is being seriously misused. There is a side to this question which has probably not occurred to those responsible, and the writer gives them the suggestion. Strenuous efforts are being made to increase the supplies of benzol, toluol, carbolic acid, &c., for the manufacture of explosives, and plants are being erected—presumably by the Government's instructions—at gas-works for the manufacture or recovery of these commodities. At a modest estimate there are at the present time in this country at least 500 coke-ovens very nearly ready for commencing operations, but which are being stopped on account of delay in obtaining materials or machinery. Particularly is this the case with engineering details and iron and steel work. Now, if these ovens were at work, they would daily be carbonizing approximately 3000 tons of coal, which would yield some 7500 gallons of benzol, and 150 tons

of tar—containing more toluol and also more carbolic acid—per day. This represents a substantial increase in production of these essential war materials—probably 6 to 8 per cent. of the total production from coke-ovens. It is suggested, therefore, that it is to the interest of the country that the Government should interfere on behalf of the coke-oven builders, and assist them to obtain the materials necessary for the completion of their plants. In most cases, a few weeks' work by one or two firms is all that would be required. Surely it should be one of the first steps of a business organization to remedy troubles like this! The demand for coke is exceedingly strong also; so that good service would be done in this direction by Government intervention.

There has certainly been a very great stimulus given to British engineers, brick makers, &c., to take for themselves a considerable volume of trade in connection with the erection of coke-ovens which has hitherto gone abroad. We admit no superiors in engineering matters; and after all there is nothing very intricate about coke-oven machinery. It is all quite straightforward work, and there should be absolutely no part of the equipment of a bye-product coke-oven plant which could not be made in this country equally as well as abroad. With regard to firebricks, there is in this country raw material as good as any in the world. What is now required is for the brick makers to study their material, and to depend a little more upon science and a little less upon rule-of-thumb when manufacturing their bricks. Attention also needs to be paid to mechanical and physical characteristics, and particularly to dimensions. Coke-oven bricks are often of rather complicated design; and it is essential that the dimensions given on the drawings should be closely adhered to. This has long been a failing point with British makers; but it is surely capable of being easily remedied.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Meeting at Newcastle-on-Tyne.

The Annual Meeting of the Association was held last Saturday afternoon, at the offices of the Newcastle and Gateshead Gas Company. The PRESIDENT (Mr. Thomas Waddom) occupied the chair. There was a fairly large attendance.

The PRESIDENT, in opening the proceedings, said the Committee did not expect a large attendance when they fixed the meeting. It had been intended that it should be merely formal, and simply for the purpose of re-electing the officers for another year. But, fortunately, their good friend Mr. Diamond had come forward and had offered to read a paper upon a subject which they would all agree was of the greatest possible interest to them at the present time. He might tell them the reason why they did not have a meeting last October, when, for the first time in the history of the Association, they had not had an October gathering, with the dinner and other functions. The excuse was, as they might quite readily guess, that we were in a condition of war. He did not know what it might be like in other parts of the kingdom, but on the North-East Coast the war had caused a large amount of work to be done, with fewer officials and staff to carry it out. This had become a very serious matter to them in Newcastle. It was the proper thing for men to go away to serve their country either in France, Belgium, or elsewhere, or in the workshops of the armament firms; but the experience of the Newcastle and Gateshead Gas Company was that during the last few weeks men had gone away whom they could not possibly replace. At least three of their employees had gone from the works who were engaged in labour for which it was impossible to find any other men at the present time. The matter had been considered by the Directors of the Company, and they had caused to be issued to the men at the works and workshops intimation that, while there was no intention or desire on the part of the Directors to restrict or put any obstacles in the way of men joining the Colours if they were wishful of doing so, the Company must consider their statutory obligations to the public to make and supply gas. Therefore they reserved the right to withhold allowances which the Company made to dependants where men had not obtained the consent of the Manager of the works to enlist. It was with much regret that the Directors had been compelled to do this. The Committee of the Association met prior to the meeting that was to have been held in October; and considering the position as it then was, they decided to recommend to the members that the October meeting be abandoned. This was done with the reserve that, if a favourable opportunity presented itself later on, a meeting could be arranged. At the present time the war was as bad as ever, and the Committee had had another meeting and had decided that last year should be no year, and that on this occasion the officers should be re-elected for another twelve months. A resolution to this effect would be submitted to them.

APOLOGIES FOR ABSENCE.

The HON. SECRETARY (Mr. Herbert Lees) read letters of apology for absence from, among others, Mr. John Bond, the President of the Institution of Gas Engineers, and Mr. W. Doig Gibb.

ANNUAL ACCOUNTS.

The statement of accounts showed that the income for the year had amounted to £109 2s. 2d., and that there was a credit balance of £9 19s. 11d. The latter sum had been transferred to capital account, which amounted to £253 12s. 10d., of which investments accounted for £241 5s.

The PRESIDENT moved the adoption of the balance-sheet, and remarked that it was quite satisfactory.

Mr. W. HARDIE (Tynemouth) seconded the proposal; and it was agreed to.

NEW MEMBERS AND ASSOCIATES.

The following new members and associates were elected.

Members: Mr. A. W. Branson, West Hartlepool; Mr. T. E. Furniss, Guisborough; Mr. C. S. Roberts, Great Ayton; Mr. Walter Plummer, Cleveland.

Associates: Mr. J. Wilfred Drake, Halifax; Mr. Frederick Short, Hetton-le-Hole; Dr. J. T. Dunn, Public Analyst for Newcastle and Gateshead; Mr. J. T. Heywood, Newcastle-on-Tyne.

MR. DOIG GIBB'S RETIREMENT.

The PRESIDENT referred to the ill-health and retirement of Mr. W. Doig Gibb as Chief Engineer of the South Metropolitan Gas Company, and moved that:

> At the annual meeting of the North of England Gas Managers' Association on the 1st of May, 1915, the members desire to express sincere sympathy with their esteemed colleague and Past-President, Mr. William Doig Gibb, M.Inst.C.E., upon his being under the necessity, owing to the regrettable state of his health, to seek relief from active service in the profession in which he has deservedly attained so high a position. And, further, to express the hope that the loss to the profession is only temporary, and that the period of rest which, upon the recommendation of his medical advisers, he contemplates taking will have the desired effect of restoring him to health. The members also tender their sympathy to Mrs. Gibb and the family, and express the confident hope that their solicitude for the beloved one will soon be dispersed by his complete restoration to health.

Mr. T. H. DUXBURY (South Shields) seconded the motion; and it was agreed to.

INSTITUTION BENEVOLENT FUND.

It was resolved that a donation of £10 10s. be contributed to the Benevolent Fund of the Institution of Gas Engineers.

OFFICE BEARERS.

A motion was agreed to that the Officers and Committee be retained in their respective positions for another year.

THE RECOVERY AND FRACTIONATION OF BENZOL PRODUCTS FROM COAL GAS.

Mr. W. DIAMOND, of Marley Hill, then read a paper bearing the above title. This will be found on p. 267.

Société Technique du Gaz en France.—We learn from the reports of the meetings of the Committee of this Society contained in the number of the "Journal des Usines à Gaz" recently to hand that, unless arrangements can be made for holding the annual meeting before the 30th of August, it will have to be abandoned for this year. In any event, no prizes will be offered. A sum of 2500 frs. (£100) has been set aside for the assistance of the managers and employees in gas-works in the invaded districts who have distinguished themselves by their devotion to their duties. The Committee have also devoted £25 as a contribution to the Benevolent Fund of the Institution of Gas Engineers.

Dr. Haldane on Asphyxiating Gas in War.—Dr. J. S. Haldane, F.R.S., one of the Metropolitan Gas Referees, and brother of the Lord Chancellor, has furnished to the War Office a report on the investigation carried out by him in France in regard to the nature and effects of the asphyxiating gas employed by the Germans in their recent attack upon the French and British lines. He says the symptoms and the other facts so far ascertained point to the use of chlorine or bromine for asphyxiating purposes; but he adds that there is evidence of the employment in German shells of other irritant substances, the effects of which are not those of any of the ordinary products of combustion of explosives. On this point the symptoms described left not the slightest doubt in his mind. Professor H. B. Baker, F.R.S., who accompanied Dr. Haldane, is making further inquiries from the chemical side.

Society of Chemical Industry.—The annual general meeting of the Society will be held in the Municipal School of Technology, Manchester, from the 14th to the 16th of July, under the presidency of Professor G. G. Henderson, D.Sc. In addition to the presidential address, the following subjects will be submitted for the consideration of the members: "Research in Chemical Industry," by Dr. M. O. Forster, F.R.S., and Mr. Chas. Carpenter, D.Sc.; "Chemical Engineering," by Dr. G. T. Beilby, F.R.S.; "Cheap Power," by Mr. Walter T. Reid; and "Patent Law," by Mr. I. Levinstein. There will be an evening visit to the University Laboratories, where demonstrations will be given by Sir Ernest Rutherford, F.R.S., Professor W. J. Pope, F.R.S., and Professor Harold B. Dixon, F.R.S. The provisional arrangements for the meeting include a visit to works, a social meeting, and the annual dinner.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Fifty-Second General Meeting, April 29.

The Spring Meeting of the Association was held last Thursday, at the Liverpool Street Hotel, London. The members and their friends—to the number of round about 100—assembled in the reception room adjoining the Cambridge Room, where they were welcomed by the President (Mr. W. B. Farquhar, of Ilford). The Chairman (Mr. William Ashmole) and the Directors of the Ilford Gas Company were the hosts at a luncheon which preceded the business meeting; and genial Mr. Ashmole was in the chair—his colleagues who were able to accompany him being Mr. A. A. Johnston (Engineer and Manager of the Brentford Gas Company), Mr. T. J. King, and Mr. C. B. Gadsdon, with the Secretary of the Company (Mr. G. H. S. Iorns). After the considerable interval there has been since the last reunion of members in an ordinary general meeting, this opening to the current year's work, through the generosity and friendship of the Chairman and Directors of the Ilford Company, was much appreciated, as was also the compliment that it embodied for the President.

After the loyal toasts had been honoured,

The CHAIRMAN said he had now to propose the toast of the afternoon. The Directors of the Ilford Gas Company were very pleased to see the members of the Association there that day; and they welcomed them very heartily. The toast he had to propose was the "Eastern Counties Gas Managers' Association," and he coupled with it the name of the President. He might say the Directors were very gratified that their Engineer had been elected President of the Association this year. The Board had the utmost confidence in Mr. Farquhar; and he (the Chairman) was sure he would prove as good a President as he was a good gas engineer. Regarding the Association generally, it was a very great satisfaction to his colleagues and himself to see such a number of scientific men who were engaged in the production of gas. His (the Chairman's) experience carried him back to the time when the manufacture of gas by small companies was not on a scientific basis. He could remember when the whole of the carbonizing plant at Ilford consisted of two iron retorts; he believed they were some 9 feet long. Things had advanced since then; but he was very glad to see that by the scientific manner in which gas was now treated, gas companies were able to fulfil the patriotic duty of producing, or assisting in producing, munitions of war which were very greatly needed. Regarding the terrible action of the Germans lately in using asphyxiating gases, he should like to put the Germans in the hands of the members of this Association; and he had no doubt that they would, if necessary, have no difficulty in poisoning three parts of the German nation. [Laughter.] They would not, he hoped, have to go so far as this. However, he welcomed the members there that day as the guests of the Ilford Gas Company; and he coupled with the toast the name of the President, Mr. Farquhar.

The PRESIDENT, in reply, said he was deeply grateful for the kind words the Chairman had used. From the personal point of view, it was very nice to have such encouraging words spoken by the Chairman of one's Company. He might mention, for the information of those who were not well acquainted with the Association, that it covered a very large area—extending from Hull to Gravesend, and from the East Coast well over the middle of the country. It did exceedingly good work; it now had a membership of about 140; and the number was growing every year. The business meetings and the chats they had in the smoke room were always productive of good results, through the exchange of confidences upon the various duties they had to perform. In the name of the Association, he thanked those present who were not members for the manner in which the toast had been proposed and received.

Mr. A. E. BROADBERRY (Tottenham) said he had been "instructed" by their Hon. Secretary to propose the next toast. He appreciated the honour implied by entrusting it to him; but Mr. Davies could not tell him whether he had been selected for this toast in his individual capacity, or in that of Vice-President of the Association, or in that of Vice-President of the Institution of Gas Engineers. However, in whatever capacity it was, he was very proud of the trust thus reposed in him. The toast was not merely an acknowledgment of the debt of gratitude they owed to the Chairman and Directors of the Ilford Gas Company, but was an expression of the heartfelt wish of the members of the Association that prosperity and success might always attend the efforts of the Directors of the Company. The members were favoured that day by the presence of the Chairman of the Company (Mr. Ashmole) and some of his colleagues. They would drink the toast not only to those present, but to those absent. They all felt very grateful to the Chairman and Directors for the kindness they had shown them. He knew the kindness would have been extended still further if it had not been for the peculiar circumstances in which the members were meeting. He would ask those present to drink heartily to the prosperity and success of the Company. With the toast he coupled the name of the Chairman.

The CHAIRMAN (who was received with applause) said he and his colleagues were most pleased to welcome the members. The present was an anxious time for all the members; and it was an anxious time for the Ilford Gas Company. Up to the present the Company had always prospered; and he believed they would do so in the future. The reason for this, in his opinion, was that the Directors had always, as far as possible, given a free hand to their engineers. They had not in any way attempted to hamper them; and they were proud the Company held such a good position, which position depended so much upon the engineer's management. They knew their engineers were qualified men; and they had had perfect confidence in them. The Directors felt they could not do better than entrust the business to them, and not interfere with the management. He only hoped that the Directors of the companies managed by the other members of the Association did the same thing, because he was perfectly certain they would do better than if they endeavoured to interfere with the engineer's part of the business. [Applause.]

THE BUSINESS MEETING.

Luncheon ended, the members almost immediately adjourned to another room for the business meeting. The PRESIDENT (Mr. W. B. Farquhar) was in the chair.

The HON. SECRETARY (Mr. J. Davis, of Gravesend) opened the proceedings by reading the minutes of a meeting of the Committee held at Peterborough last November to deal with formal matters, owing to the passing of the ordinary general meeting, in view of the war. Following were also the minutes of a special meeting of the members held at Cambridge to consider the question of toluol extraction.

The minutes were confirmed.

THE LATE MR. JOHN CARTER.

The HON. SECRETARY said this was the first meeting of the Association since the lamented death of Mr. John Carter, of Lincoln. He received from Mr. Mainwaring a letter announcing with very great regret the death of their friend. He (Mr. Davis) had only to ask, in order that it might be placed on their records, that some member would move a vote of condolence with Mrs. Carter in her great bereavement.

The PRESIDENT said it was his melancholy duty to move a vote of condolence with Mrs. Carter on the lamented death of her husband. It was unnecessary for him to say anything about their late member. Mr. Carter was well known to every member of the gas profession; his disposition was of the most genial; and he was the friend of everybody. He would ask the members to pass the vote upstanding.

This was done in silence.

The HON. SECRETARY remarked that a letter of condolence had already been forwarded to Mrs. Carter. The Association also sent a wreath; and there was good representation of their members at the funeral. There would be no necessity to write a further letter, in view of the fact that one had already been sent, and a reply had been received from Mrs. Carter.

ELECTION OF NEW MEMBERS.

On the motion of Mr. F. M. PATERNOSTER (Felixstowe), seconded by Mr. JOHN TERRACE (Grimsby), the membership roll was extended by the names of Mr. Henry D. Lamb, of Brentwood, and Mr. Arthur W. Sumner, of Grays.

ANNUAL REPORT AND ACCOUNTS.

Moved by Mr. H. WIMHURST (Sleaford), and seconded by Mr. E. W. SMITH (Chelmsford), the annual report and accounts were taken as read. The former briefly sketched the proceedings of the year; the concluding paragraphs being as follows:

The year commenced with a membership of 134. During the year, nine new members have been elected, four have resigned, and, with regret, the Committee announce the death of one member—Mr. C. N. Brown, of Gorleston and Southtown. The total membership at the end of the year was 138.

The accounts show a balance in the Hon. Treasurer's hands at the end of the year of £23 19s. 7d.; the subscriptions received amounting to £64 11s. 6d., and the expenditure to £61 11s. 3d. The balance brought forward from last year was £20 9s. 4d.

The Commercial Sections have met as usual on various occasions, and a record of their works as given in their annual reports has been sent to every member of the Association. The Committee are glad to believe that the importance of their work is generally acknowledged, but would again impress upon those members who have not yet joined, the necessity for the general good of the Association for doing so without delay.

TWO VICE-PRESIDENTS.

The HON. SECRETARY, on behalf of the Committee, moved—

That Rule 6 be amended as follows: After the word President, the words "Vice-President" be struck out and the words "Senior Vice-President, Junior Vice-President, Secretary, &c." be substituted.

That Rule 7 be altered to "The President, Vice-Presidents, Secretary, &c."

He explained that he had often felt the inconvenience of not having a Committee meeting which he had thought satisfactorily met requirements. A quorum of three was hardly sufficient for

an Association of their calibre. In the early days when they mustered about 60 or 70 members, it was ample; but now that they had about 140 members, he thought they ought at least to have another Vice-President. The amendment simply meant that they were adding another Vice-President to the Committee; and the members were preparing themselves with two successors, instead of one, to the chair.

Mr. H. WIMHURST seconded the motion.

Mr. J. H. TROUGHTON (Newmarket) remarked that, in his opinion, instead of having an extra Vice-President, it would be far better to have the rules altered so that the retiring President remained for two years an *ex-officio* member of the Committee. He thought this would probably meet the object the Secretary had in view; and it would provide for a continuity in the management being carried out in a proper way. In the event of a Senior and Junior Vice-President being elected, it would mean something like three years before the latter reached the chair. In that time, many things might happen; and it had been suggested to him that it might be very difficult to, under the circumstances, get a Junior Vice-President. Therefore, to meet the contingency, he should like to propose, as an amendment, that the retiring President should remain *ex-officio* a member of the Committee for two years.

There was no seconder to the amendment; and the motion of the Hon. Secretary was carried with only two dissentients.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—In the first place, allow me to express my sincere thanks for the honour you have done me in electing me your President. As this is the first general meeting of the Association at which I have had the privilege of occupying the chair in this capacity, I take the opportunity of placing on record my appreciation of the confidence you have placed in me, and trust that my efforts and conduct in this honourable position during my term of office will fulfil your expectations and meet with your approval.

THE WAR: ITS EFFECT ON THE GAS INDUSTRY.

When the members attended the meeting at Lowestoft a year ago, liitle did they dream that within three months from that date the country would be plunged into war—a war of such a magnitude surpassing anything ever experienced during the history of the world; and although only eight or nine Powers are immediately participating in this great struggle, the general conditions brought about are so far-reaching that there is practically no country on the face of the earth that is not feeling the effects of this tremendous upheaval. Our thoughts and good wishes go out to the gallant body of men who are risking their lives in the trenches, and have left home and dear ones for the good of their country. I am sure that we, as patriotic Britons, desire to see speedy success crown their efforts; and when in due course victory is proclaimed, may it be of such a decisive character that lasting peace will be established.

At the present moment we are living in extraordinary times; the war having created a condition of affairs unthought-of. The whole industry of the country has been seriously affected, and the general routine of business thrown entirely out of gear. Some industries which before the war were struggling to keep themselves from disappearing altogether have had a new lease of life, and have lately experienced a prosperity hitherto unheard-of, while others have been affected in an adverse manner. These exceptional conditions being so general, it is quite a natural consequence to find our own industry affected; and the ingenuity of gas managers has been fully taxed to meet and overcome the many problems and difficulties which have arisen.

MANTLE SUPPLIES.

The first difficulty with which we had to contend was the question of gas-mantle supplies. Right from the beginning of this most important industry we have been dependent upon Germany for the major portion of our requirements. In the "JOURNAL" for Aug. 25 last, there appeared an article giving a few figures from an official statement published in Germany previous to the war; and it gave some idea of the enormous number of mantles exported by that country. During 1913 no less than 65,666,389 mantles were exported; the weight being 356 metric tons. Out of this quantity, England took 195 tons, representing, roughly, 36,000,000 mantles. There is, of course, a considerable number of mantles manufactured in England; but they only represent from 30 to 40 per cent. of our requirements. Here, again, in the case of our own manufactured articles we have had to buy the necessary chemicals from German syndicates. When the supply of foreign mantles was stopped, something in the nature of a scare arose, and prices advanced to exorbitant figures. Doubts were expressed on every hand as to what would occur when no more mantles could be procured; but, fortunately, we have successfully weathered these trying times. Steps have been taken to put the mantle industry in this country on a better footing; and there is every indication that in future the supply will be equal to the demand. As I understand there is a difficulty in procuring the fire-clay rings for inverted mantles, it should be the policy of every manager to collect these rings, as well as the mantle ash, so that they can be used again if necessary.

COAL.

While the question of mantle supplies was certainly a very serious one, it was not one to completely stop our industry, as it was always possible to revert back to flat-flame burners if the situation demanded it, although the incovenience would have been very great. We are, however, faced with a problem which is even more serious than the mantle question—viz., that the supply of coal. Many undertakings, particularly those who have been dependent on sea-borne coal, have experienced the greatest difficulty in procuring supplies, and in a number of instances have barely been getting sufficient quantities to keep their works going. The supplies recently have certainly improved, but a few months ago they caused considerable anxiety. In many instances gas managers with stores practically empty have had to petition the Government to allow coal to come forward, and thus prevent a failure of gas supply; and it speaks volumes for the management of gas-works generally that works have been kept going in a satisfactory manner under these adverse conditions.

I think every gas manager who has during this crisis been in the fortunate position of having fairly good stocks, and getting fairly good supplies, can sympathize with his brother managers who have not been so fortunate. Coal at a reasonable price is absolutely necessary for our particular business. If we take the case of an ordinary manufacturing concern, coal is used as a means to produce steam for motive power to enable the manufacturer to work up his raw material into the manufactured article; and should there be a rise in the price of coal, this only represents a very small increase in his working costs. If, however, the price of his raw material is raised, this naturally affects him to a considerable extent, and he has to raise the price of his finished article. To the gas industry coal is the raw material, and any increase in the cost has a material effect on the cost of the gas and the working results of the undertaking.

Many reasons are given for the increase in the cost of coal. The colliery owners claim extra expenses incurred through the shortage of men and the difficulty in getting coal-waggons. There is also the increased labour cost in other directions; and, in the case of sea-borne coal, freights have increased tremendously. Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company, when stating the reasons for the advance which his Company had to make in the price of gas, gave some startling particulars with regard to the rise in shipping rates; his statement being as follows:

> The company had chartered ships to bring its coal to London. The Government took these steamers, with others, for the supply of coal to the fleet. The withdrawal of so many steamers from the coasting trade artificially inflated the prices asked for those not so commandeered. After considerable pressure, the Government at last released some of the enemy steamers interned at various ports; but, instead of hiring them at the prices paid for the commandeered steamers—say, from 3s. 6d. to 4s. per ton of coal carried—the Government has actually charged, and this the Company has paid, no less than 10s. per ton. Who can blame the shipowners for following so bad an example, even though they may be ashamed of doing so?

When we recollect that 1s. per ton advance in coal represents 1d. per 1000 cubic feet, it requires only a very simple calculation to realize the serious position with which the industry is faced.

While on the subject of coal, we may well ask ourselves what the future has in store for us with regard to fresh contracts. We hear rumours of increases ranging from 5s. to 10s. per ton; and I am afraid that they will not remain as rumours, but will materialize into grim realities. If such is the case, the outlook for the future is not promising. The question which is exercising the minds of managers at the moment is whether contracts ought to be entered into now or left over until later in the season. There appears to be a great diversity of opinion on this point—some engineers recommending gas companies to hold their hands, while others advise making contracts immediately on the best terms obtainable.

These problems are certainly very difficult to settle; and I am afraid, as things are at present, it lies with each individual manager to go into the market when he considers it opportune to do so, and then decide for himself according to the quotations he has received. The difficulty in my mind is not so much the getting of the coal for immediate use as the getting of sufficient quantities to make up stocks for the coming winter; and if I might here be permitted to offer any advice, I should certainly advise managers not to deplete their stocks in any way, but to hold on to them and, if possible, increase them. The fact is very often lost sight of that in using coal from reserve stocks there is a certain amount of cost in removing it. I am, of course, referring to reserve stocks which are stacked in the open, or in stores apart from the retort-house. This coal has cost money to put in its place in the first instance; and if it is used, it not only costs money to remove it but also costs money to again replace it. In many instances it will be found almost as cheap to buy fresh coal; the saving in the many handlings of the stock coal compensating, if not wholly, certainly to some extent, the increase in the price which might have to be paid for fresh deliveries. There is a further advantage that the coal stacked in the open for emergency purposes has become weathered, and it is more profitable to leave it as it is and use the fresh-wrought coal.

It is needless for me to go fully into the various coal troubles

experienced by gas undertakings. My company has felt the effects of these to a certain extent, although we have been fortunate in being able to procure good supplies. The greatest difficulty we have experienced has been more with regard to the method of delivery than the getting of the coal itself; the works at Ilford being laid down to deal entirely with sea-borne coal. The coal is brought up the River Roding in barges to alongside the works, where it is unloaded by means of cranes, and shot direct into the coal-stores through shoots in the roof. There is therefore very little handling required. Unfortunately, the major portion of our sea-borne coal has been cancelled, and we have had to purchase rail-borne coal to make up our quantities. The station is fully a mile from the works; and as the whole of the coal has to be carted, it will be realized that it means a considerable amount of work. The carting problem has also been a difficult one; it being practically impossible to get the necessary horses and carts to meet our needs. This fact, together with the amount of handling of the rail-borne coal, has not only made it a very awkward business, but has tended to increase the price considerably. I should here like to mention that the railway authorities have done exceedingly well in getting our coal forward; and I have always found the officials very willing to give us every advantage they can in getting our supplies in.

INCREASES IN THE PRICE OF GAS.

Unfortunately, on the top of these high prices for coal we have increased prices for practically the whole of our other goods, such as tubes, fittings, mantles, burners, &c.; and many companies have had to pay increases in wages to their workmen. All this extra expenditure must be met, and the only way open to gas undertakings is to advance the price of gas. Some indication of what is required to meet necessary expenses can be gathered from some of the advances recently made. In London, we have the case of the Gas Light and Coke Company advancing their price by 6d. per 1000 cubic feet; the South Metropolitan Company have increased their price by 8d.; the Commercial Company by 4d.; the Wandsworth Company by 4d.; and the Lea Bridge Company by 2d. These are only examples of similar advances which have been made practically all over the country. It is regrettable that these steps have had to be taken, as we, as a body of gas managers, have always prided ourselves on trying to benefit the public with cheap gas; and to have to increase the price to such an extent is good neither for the consumer, company, nor industry generally. The only consolation we have is the fact that these increases are absolutely forced upon us through circumstances over which we have no control.

Fortunately, during the period of high coal prices companies, as a rule, have had very favourable oil contracts running; and where the deliveries of oil have been good this has no doubt been a considerable help, not only in keeping down the cost of production, but also in ekeing out coal stocks. Unfortunately, the oil market has increased laely, and I am afraid that future contracts will have to be made at a higher figure than we experienced a few months ago.

COKE AND OTHER RESIDUALS.

Owing to the scarcity of coal for domestic and industrial purposes, the market for coke has been exceedingly brisk. Whereas a short time ago the difficulty was to dispose of the coke, now it is a question of how to meet the demand. During the last year or two coke accumulated to a large extent, and its storage taxed the resources of managers who had very little room to spare. These stocks have, however, disappeared; and the scarcity of this valuable product has had the effect of considerably enhancing its value. The market at present is very good; and as there is every indication that we will commence next winter with practically no stocks, the prices which we will be able to command during the winter months ought to compensate to some extent the high price which we will have to pay for coal.

With regard to the other two bye-products—tar and sulphate of ammonia—the returns from the former have been very disappointing. Before the war tar was realizing a very fair figure; but, owing to the difficulty in dealing with the pitch, the distillers are not in a position to offer good prices. As a matter of fact, at one time it was a question whether the distillers could continue to take tar; but this difficulty has evidently been overcome.

Sulphate of ammonia, on the other hand, has recently shown a decided improvement. The market value before and after the war is directly opposite to that of tar. A year ago it was a case of selling the salt at whatever price could be obtained, but the market has been gradually improving, until we are now receiving what might be considered a fairly reasonable figure. The Sulphate of Ammonia Association is proving a very useful help to gas managers in keeping the market values of this product before them. My Company was rather late in joining the Association; but during the short time we have been members, the particulars given respecting prices and markets have been very useful. As these figures are received each week, it makes one feel that he is in closer touch with the markets than he was when not a member of the Association.

WORK EXTENSIONS AND MARKETS.

In giving you the foregoing, I have endeavoured to look upon the effect of the war on the gas industry in a general way. I had cherished the hope of giving in my address a few particulars of extensions in my own works. For some considerable time we have contemplated putting down new carbonizing plant, telpher plant, coke-hoppers, sulphate of ammonia plant, washing plant, &c., and were only waiting for an opportune time when the market was favourable for putting this work in hand. The market previous to the war did not encourage anyone to go in largely for extensions unless they were absolutely necessary, and it was hoped that in due course we should have a more favourable opportunity. Instead of getting better, the present dislocation of business has made matters worse. I might, however, add that it is essential that we should proceed with certain extensions during the next year or two, to meet the growing demand of our district; and I hope that I may possibly have the opportunity of describing these extensions at some future date.

In submitting to you a few general remarks on our ordinary practice at Ilford, not only under normal conditions but also under war conditions, you will no doubt find them similar to your own experiences. A few years ago I had the pleasure of giving the Association a brief summary of our outdoor method of working; and if to-day I incorporate a few details respecting this department, and should overlap what I have already mentioned, I would beg of you to excuse me. Some of the details respecting outdoor business cannot be too often mentioned.

THE LIGHTING RESTRICTIONS.

Ilford, in common with the whole of London and certain towns within a given distance of the coast, has felt the full effects of the Government Order restricting the outside lighting of shops. This has had a material effect on the output of gas; and as we have had no bodies of troops in our district, there has been no compensating gas consumption to make up for this loss. It is not only in the reduction of the gas consumption where we are affected, but there are serious effects in other directions. It is a common practice in Ilford for shopkeepers to light their windows entirely by means of outside lamps, and in the case of our high-pressure system this is the general method adopted. The extinguishing of these lamps naturally left the windows in complete darkness; and to overcome this difficulty a number of shopkeepers had electricity installed, so as to show off their goods. It is true that they had to put in low-power lamps, and shade them properly, but the fact remains they have had electric light installed where formerly there was none. When we get back to normal conditions, it is a doubtful point whether the shopkeepers will remove the electric fittings from the windows and depend entirely upon the outside lighting, or whether they will retain same for occasional use.

In some instances I am afraid it will mean the permanent loss of gas consumption. The question of how to deal with lamps let out on hire has been rather a difficult one. In my own district we hire out low-pressure lamps at £1 per annum, and clean and maintain same; the gas being registered through a meter. We also have high-pressure lamps where each lamp is charged at a fixed rate per quarter, inclusive of gas. Notwithstanding the fact that the lamps are depreciating in value, and have to be seen to at regular intervals to prevent them from becoming dirty and unsightly, my Company decided to make no charge for the period they have been out of use. This is, of course, a very serious loss of income; and it seems rather unfair that the Company should have to bear the whole cost. It is, however, undesirable to charge the consumer for something which he feels he has never had; and even allowing for the fact that these burners and lamps have to be kept in order, although they are not in use, it would be very bad policy on the part of the Company to incur the displeasure of the consumer by trying to make him pay even a portion of this charge. No doubt his answer would be that we could remove the lamps, and he would let us know when he required them refixed. Burners on maintenance have been dealt with in much the same way; no charge being made on burners out of use during the whole or major part of any quarter. I think the shopkeepers in our district fully appreciate the position we have taken up, and I am sure they are willing to give us credit for meeting them in a very fair manner.

ADVERTISING.

Advertising is assuredly one of the steps to a successful district business. It is necessary for a gas company to keep itself before its consumers and bring to their notice all the latest appliances and the advantages of gas. Where a district is scattered, a systematic canvassing campaign might be carried on; and though I have had no personal experience, I understand that some companies have found the services of a lady canvasser very useful. The district under my control is a very compact one, and the inspectors are constantly about, and, being particularly keen in promoting the Company's business, they look upon canvassing as part of their duties. The company that is content to sit down and wait for business to come to it in these days of keen competition with electricity, will not find this method a profitable one, and as years go on advertising and canvassing will have to be more and more adopted to secure success. A show-room is a very useful addition to an undertaking, particularly if it can be erected in a prominent part of the town. Where it is possible, the collectors' office should be placed behind the show-room, so that consumers coming in to pay accounts must pass through the show-room, and in this way be brought into contact with various appliances which are on view. Consumers in this way have brought to their notice many articles they would not otherwise

have troubled their heads much about if they had to come into the show-room purposely to see them.

BRITISH COMMERCIAL GAS ASSOCIATION.

I should like to put in a word for an association which has become a very useful addition to the gas industry—*i.e.*, the British Commercial Gas Association. The amount of good this Association has done in promoting the use of gas cannot readily be ascertained, and the quantity of useful literature which is issued to subscribing companies is really surprising. This literature not only covers general hints with regard to advertising gas in the manager's area, but also provides suitable matter, leaflets and booklets, which can either be used as they are issued or altered to suit local needs. The Association has also been a means of enabling managers to procure suitable advertising blocks at low prices, and I can speak personally of the great convenience in having these blocks for advertising in programmes and newspapers. There is hardly a subject relating to the commercial side of a gas undertaking which the Association has not touched upon, and it has given articles bringing the latest information to the notice of managers, and has raised discussions and hints which have proved of the greatest use. The Secretary of the Association is always willing to assist any manager who is faced with a problem on which he would like to have further information; and by getting such information it makes him feel more confident in carrying out any scheme for the improvement of his outdoor business.

Another important thing with respect to the district is to keep on good terms with the local builders. Give them every facility to encourage their tenants to go in for gas lighting and make arrangements for the necessary pipes to be put in while the house is being erected. At the time of carcasing the house it is policy to run fire supplies to practically every room, fix a point for a cooker and copper, and, if thought advisable, leave a suitable point for a geyser. Even though you have to do this work at a low price, it will pay in the long run, as the cost of putting in a pipe for a gas-fire previous to the house being finished is much lower than when carpets and floor boards have to be taken up and walls cut about to get the pipes fixed. There is also the further advantage that a consumer will often have a gas-fire fixed if the pipes are in position, whereas he will not trouble about it if it means a lot of pipe-laying.

PREFERENTIAL CHARGES FOR ELECTRICITY.

I think it will be of interest to the members if I give a few particulars respecting the action of *The Attorney General (at the relation of the Ilford Gas Company) v. Ilford Urban District Council.* I would like to make it clear that in giving you these particulars they are not given in a spirit of exultation over our opponents, but merely to indicate the various points on which the case was fought, in the hope that they may prove useful to managers who are faced with similar circumstances, and whose company is suffering from illegal administration of electrical undertakings.

STATEMENT OF CLAIM.

(1) By the Ilford Electric Lighting Order, 1898 (hereinafter called the Order) confirmed by the Electric Lighting Orders Confirmation No. 3 Act, 1898, the defendants were authorized, subject to the provisions of the Order and of the Electric Lighting Acts, 1882 and 1888, to supply electrical energy for all public and private purposes within the Urban District of Ilford as constituted at the commencement of the Order.

(2) In pursuance of the powers of the Order, the defendants have erected a generating station and laid down and constructed mains and other works, and, by means thereof, are supplying electrical energy within the area of supply mentioned in the Order.

(3) The defendants are also carrying on the business of supplying, selling, and letting on hire electric lamps, electric heating and cooking apparatus, electric motors, and other electric fittings, appliances, and apparatus, and for that purpose have provided, and are carrying on, show-rooms within the said area of supply.

On the 19th of March, 1914, the Electricity and Lighting Committee of the defendants reported to the defendants that they had authorized expenditure up to a total sum of £500 in a further purchase of heating and cooking apparatus for hire and hire purchase purposes, and that a draft of the usual agreement in the matter would be submitted by the Clerk to the next meeting of the Committee. The said report was subsequently adopted by the defendants.

The defendants have no power under the Order or the Electric Lighting Acts or otherwise to carry on the said trade or business and the carrying on by them thereof is *ultra vires* and illegal.

(4) On the 15th of April, 1914, the defendants issued a public notice inviting tenders for the erection and completion of, amongst other buildings, an electricity show-room at Green Lane, Goodmayes, Ilford. The said show-room is intended to be used by the defendants for the purposes of the said trade or business so carried on by them of providing, selling, and letting on hire the said electrical apparatus, fittings, and appliances.

(5) In addition to selling and letting on hire lamps and other fittings and appliances, the defendants maintain, repair, and clean lamps, fittings, and appliances sold or let by them, and also other lamps, fittings, and appliances on premises of consumers not sold or let by them.

(6) The defendants are unlawfully expending moneys borrowed for the purposes of their electrical undertaking and other moneys in their hands in carrying on the said unauthorized trade or business and for the purposes mentioned in the last preceding paragraph.

(7) In the month of November, 1913, the defendants issued the following public notice:—

ILFORD URBAN DISTRICT COUNCIL.

Reduction in Price of Electricity.

After the readings of the meters for the quarter ending Christmas, 1913, the following additional tariffs will be available.

(1) Domestic contract rate. For houses electrically lighted throughout:

(*a*) A fixed rental of 12½ per cent. per annum on the rateable value of the premises, payable in four equal quarterly instalments of 7½d. in the pound per quarter.

(*b*) A rate of ½d. per unit for all current supplied for lighting, heating, cooking, &c. Less 5 per cent. discount for prompt payment.

EXAMPLE. The annual cost of electricity supply to a house rated at £28, and using 300 units per annum for all purposes, will be as follows:—

12½ per cent. on £28 (2s. 6d. in the £) . .	£3	10 0
300 units at ½d.	0	12 6
	£4	2 6

If the consumption be doubled, by additional use for heating or cooking, the cost will be:—

12½ per cent. on £28 as above.	£3	10 0
600 units at ½d..	1	5 0
	£4	15 0

(2) Flat-rate for shops, warehouses, workshops, or business premises:

For premises electrically lighted throughout, and using or paying for electricity up to—

2500 units per annum	3¼d. per unit
2501–5000 units per annum	3 "
5001–10,000 "	2⅞ "
10,000 units per annum and upwards .	2½ "

Less 5 per cent. discount for prompt payment.

(3) Hotels, public houses, and other premises having equivalent lighting hours, electrically lighted throughout:—

2¼d. per unit, less 5 per cent. discount for prompt payment.

(4) Heating and cooking through separate meter, 1d. per unit.

In addition to the above, the following existing lighting rates will remain in force, and consumers may be charged at either of these rates if preferred.

(1) A flat-rate of 3¼d. per unit.
(2) A maximum demand rate of 6d. and 1d.

Any further particulars or information may be obtained on application at the Council's show-room, where the latest types of radiators, heaters, cookers, &c., may be inspected.

(8) The proposal to charge lower rates to consumers whose premises are lighted entirely by electricity than to other consumers constitutes an undue preference to the former, and contravenes sections 19 and 20 of the Electric Lighting Act, 1882.

(9) On the 20th of April, 1914, the above-named relators, the Ilford Gas Company, wrote to the Defendants, calling attention to the before-mentioned report of the 19th of March, 1914, and inquiring by what authority the defendants proposed to expend money for the purposes mentioned in such report; but notwithstanding that the said relators wrote several subsequent letters inquiring for such information, the defendants have not referred to any authority for the expenditure of money for such purposes or stated that they will abstain from such expenditure.

(10) The defendants intend to continue the said wrongful acts unless restrained by injunction.

The plaintiff claims:—

(1) A declaration that the defendants have no power to carry on the trade or business of providing, selling, or letting on hire electric lamps, electric heating or cookery apparatus, electric motors, or other electric fittings, appliances, or apparatus.

(2) A declaration that the defendants have no power to provide a show-room for the exhibition of electric lamps, motors, fittings, appliances, or apparatus.

(3) A declaration that the defendants have no power to maintain, repair, or cleanse electric lamps, motors, fittings, appliances, and apparatus on their consumers' premises.

(4) A declaration that the defendants have no power to expend or use for any of the purposes mentioned in the last preceding declarations any of their moneys, plant, property or servants.

(5) An injunction to restrain the defendants from committing any of the acts referred to in the foregoing declarations.

(6) A declaration that the reduction in price for electricity proposed to be made by the defendants in respect of houses, shops, warehouses, workshops, and other premises electrically lighted throughout constitutes undue preference to the owners or occupiers of such premises, and is in contravention of sections 19 and 20 of the Electric Lighting Acts, 1882.

(7) An injunction to restrain the defendants from giving, by the means aforesaid or otherwise in connection with the supply of electricity by the defendants, any undue preference to the owners or occupiers of premises electrically lighted throughout.

(8) Costs.

ORDER.

This action coming on for trial before this Court this day in the presence of Counsel for the plaintiff and for the defendants and upon reading the writ of summons issued on the 13th of June, 1914, and the pleadings delivered in this action, and upon hearing what was alleged

by Counsel for the plaintiff and for the defendants and the defendants by the Counsel submitting to judgment.

This Court doth declare that the defendants have no power to carry on the trade or business of providing, selling, or letting on hire electric lamps, electric heating or cooking apparatus, electric motors or other electric fittings, appliances or apparatus.

And this Court doth declare that the defendants have no power to provide a show-room for the exhibition of electric lamps, motors, fittings, appliances, and apparatus.

And this Court doth declare that the defendants have no power to maintain, repair, or cleanse electric lamps, motors, fittings, appliances, and apparatus on their consumers' premises.

And this Court doth declare that the defendants have no power to expend or use for any of the purposes mentioned in the preceding declarations any of their moneys, plant, property, or servants.

And this Court doth declare that the reduction in price for electricity proposed to be made by the defendants in respect of houses, shops, warehouses, workshops, and other premises electrically lighted throughout constitutes undue preference to the owners or occupiers of such premises, and is in contravention of sections 19 and 20 of the Electric Lighting Acts, 1882.

And this Court doth order that the plaintiff be at liberty to apply for injunctions to restrain the defendants from committing any of the acts referred to in the first four foregoing declarations, and for an injunction to restrain the defendants from giving, by the means aforesaid or otherwise, in connection with the supply of electricity by defendants any undue preference to the owners or occupiers of premises electrically lighted throughout.

And it is ordered that the defendants, the Urban District Council of Ilford, do pay to the plaintiff his costs of this action, to be taxed by the Taxing Master.

At the half-yearly meeting of the Company, my Chairman commented on the action in the following manner:

With regard to the action, *The Attorney-General (at the relation of the Ilford Gas Company) v. Ilford Urban District Council*, I would remind you that the Council promoted a Bill in 1904 which, among other provisions, proposed to authorise them to sell, let for hire and fix, set up, alter, repair, and remove fittings and apparatus for lighting and motive power, and for heating and cooking purposes. Your Company petitioned Parliament asking, if these powers be granted, that the Council be compelled to make the undertaking self-supporting—that is, that the rates should not be charged with any loss upon the undertaking. This the Parliamentary Committee granted, whereupon the Ilford Urban District Council withdrew the whole of the clauses in the Bill relating to the electrical undertaking.

Since that time the Directors noted that the Council have entered into an ever-increasing business in electrical fittings and apparatus, and, in the interests of the ratepayers generally, as well as of the Company, came to the conclusion that they would not be fulfilling their duty to allow it to continue, as there was a very great question whether this business was not being carried on at a loss, and was, therefore, likely to become a burden upon the rates. Possibly no action would have been taken had not the Council, at the beginning of last year, announced a tariff which gave preferential rates to the electrical consumers who did not use gas for any purpose. The action went entirely in favour of this Company and against the Council; and I hope in future that they will conduct their business in accordance with the powers Parliament, in its wisdom, thinks fit to give them, and not imagine that their position as makers of bye-laws, and in many respects enforcers of the law, makes them any less amenable to the law themselves.

His summing up of the matter clearly shows that the Council were doing something which they originally tried to get powers to do, but ultimately withdrew their application. There was, therefore, no excuse for them not knowing that they were acting wrongly.

EDUCATION OF GAS-FITTERS.

With regard to this very important subject, it is interesting to know that the work carried out in forming classes has met with considerable success. This is the first year of the scheme; and seeing that we can show such good results under the adverse circumstances, it speaks well for the future. The war no doubt has considerably affected the attendance both at the classes and at the examinations. In my own works, we lost quite a number of our fitters of an age suitable for attending these classes. As a matter of fact, a number had started these classes previous to joining the army. In my opinion, these classes are going to do a power of good; they not only teach the young lads who are coming out as gas-fitters how to use their tools and how to do certain work, but why these tools are used and why the work is done in certain ways. It is usually recognized that a workman with a good practical knowledge and little theory is worth much more than one having all theory and no practice; but where it is possible to make our fitters into good practical men with a sound theoretical knowledge we will then get the ideal fitters.

The following particulars give the number of classes held, the number of students attending, and the centres at which the examinations were held.

Classes held . . 34 Number of students attending . 482

Candidates entered for written examinations:

Grade I.	154
Grade II.	84
Final	47

Practical Tests Held at—	*Centres for Grade I. (Written Examination Only)—*
London—	Acton and Chiswick
East Ham	Birmingham
Hackney	Cork
Westminster	Exeter
Acton and Chiswick	Grimsby
Birmingham	Huddersfield
Cambridge	Liverpool
Cardiff	Newport (Mon.)
Exeter	Norwich
Glasgow	Pontypridd
Grimsby	Portsmouth
Pontypridd	Salford
Salford	Swansea
West Bromwich	West Bromwich
	Wolverhampton

CARBONIZATION OF COAL.

The carbonization of coal still demands a considerable amount of attention from gas engineers, and there is some doubt remaining in their minds as to which is the best type of carbonizing plant. In every calling in life, whether it be in the political world, the literary world, or the business world, there are always two sides to every question and a difference of opinion on all matters. So, too, in our own profession there is this difference of opinion; and while we get managers working on different lines in many of their departments, the retort-house and carbonizing of coal still remain the premier questions for interesting discussions. The question of retort extensions has given gas managers much food for thought. If the question be asked of the majority of managers as to the relative merits of vertical and horizontal retorts, one would get such a diversity of opinion that he would be forced to come to the conclusion that both were good. There is no doubt that vertical retorts are looked upon to-day with greater favour than they were some time ago; and there appear to be indications that this favour will increase.

I have personally come across works where verticals have been decided upon not only because they were thought to be the modern method and capable of giving good results, but also to a great extent on account of the small area they occupy. The question of want of space has often turned the scale in favour of verticals, where possibly horizontals would have received more consideration had there been room. When we hear of high makes per ton of coal with horizontal retorts using modern charging and discharging machines, and when the average manager is thoroughly conversant with this system, and knows what the cost of repair and renewals will be, it is certainly something in their favour. One of the strong points in favour of verticals is the regular make which goes on hour by hour at approximately the same rate; and where the washing and scrubbing plant has reached its maximum capacity and the works mains are getting too small, this regular quantity is certainly a great convenience and removes a source of anxiety to the manager. There is also the further advantage that the quality of the gas remains regular throughout the whole twenty-four hours. The labour question is also a strong argument in favour of verticals, as there is practically no manual labour, and the duties of the men in charge are of a simple character. The question of labour in a gas-works is becoming more and more a deciding factor in forcing companies to put down labour-saving machinery and plant; and if by doing so it enables the company to supply gas at a cheap rate, the company is working not only in its own interests but also for the benefit of the consumer.

In considering the question of carbonizing plant for my own works, I candidly admit that I have not yet decided upon the system, although the matter is receiving most careful consideration. We have the option of either putting down horizontals or verticals, as we have sites suitable for both types. In the event of installing horizontals, it means the construction of a retort-house some distance from the present one; whereas should verticals be adopted, we have an available site at the end of our inclined-retort house. By utilizing this space it will enable us to keep the whole of our carbonizing plant practically under one roof, and under the supervision of one retort-house foreman, whereas in the other case it either means that the retort-house foreman will have to go from one house to the other or have a foreman to each retort-house. There is therefore not only the merits of the settings to consider when putting down new plant, but also the various peculiarities and varying conditions found in each works; and when these are all taken into account, it becomes no easy matter to decide which course to adopt.

The manufacture of coal gas at Ilford is carried out entirely by means of inclined retorts; and I must admit that we have found this system a very successful one and easily managed. The coal used is a mixture of Durham coal, Yorkshire coal, and Barrow nuts, in the proportion as near as possible of two of Durham, one of Yorkshire, and one of Barrow nuts. This mixture works exceedingly well, being easily charged and gives a good level charge throughout the whole length of the retort. The resultant coke is of such a nature that the discharging of the retorts is quite a simple matter. The make of gas from this mixture ranges from 12,500 to 13,000 cubic feet per ton. The mixture referred to is what we use under normal conditions, but at the moment we are working with a much larger percentage of Yorkshire coal and are using a class of coal of which we have had no previous experience. Notwithstanding this fact, our working still continues to give most

satisfactory results, and this new mixture appears to suit our inclined retorts.

MANUFACTURING PROCESS AT ILFORD.

As I hope to have the pleasure of seeing a number of the members at Ilford to-morrow, I might here take the opportunity of briefly describing the process of manufacture adopted and the plant used. After the coal has been delivered into the stores, as already described, it is drawn through shoots in the floors into a Zimmer conveyor which runs longitudinally throughout the whole length of the building. This conveyor is in a subway, so that the attendant can get to any of the shoots and draw coal from any part of the stores; and by this means he can mix the coal in the proportions we find most suitable for our requirements. This longitudinal conveyor delivers into a cross conveyor, which carries the coal to the elevator boot. The coal can be passed through a breaker if necessary; but as the major portion of our coal is of a small character, the breaker is seldom brought into use. The coal is elevated by means of twin elevators to the storage hoppers, from which it is drawn and charged direct into the retorts. The twin elevators can be worked independently of each other, and the whole plant is driven by Marshall engines in duplicate.

The retort-house contains twelve beds of inclined retorts, 20 feet long, being set in beds of eights, and was laid down to produce about 1½ million cubic feet per day. The coke from the retorts discharges through openings in the drawing stage floor into waggons running on rails underneath. These waggons are drawn outside the retort-house, where the coke is quenched and taken to the coke heap. After the gas leaves the retort-house it passes through a Morris and Cutler water-tube condenser, which has a capacity of 1½ millions per day, and then to the exhausters. The exhausters are in duplicate, each set being capable of dealing with 100,000 cubic feet per hour. The scrubbing and washing plant consists of two Livesey washers, two Cockey washers, and two rotary scrubbers—one being of the Holmes type and the other of the Kirkham type. This washing plant can deal with about 1½ million cubic feet per day, when clean; but we find that we get the best results when we are only putting through about 1 million to 1¼ millions. From the scrubbers the gas passes direct to the purifiers. There are two sets of coal-gas purifiers, one set consisting of four boxes 24 ft. by 27 ft. 6 in. by 5 ft., and the other of four boxes 30 ft. by 27 ft. by 5 ft. 6 in. The station meter is capable of dealing with 150,000 cubic feet per hour.

The carburetted water-gas plant consists of two sets erected by Messrs. Humphreys and Glasgow—one set being capable of making 650,000 cubic feet per day and the other 750,000 cubic feet. The gas as it is made passes direct into a holder which has a capacity of 390,000 cubic feet, and from which it is drawn by means of exhausters, laid down in duplicate, and passes through its own purifiers and meter. The purifiers are four in number, and are 20 feet square. The outlets of the coal gas and water gas meters are joined into one common main, and here the two gases mix and go direct into the large storage holder, which has a capacity of 2 million cubic feet. The governors regulating the gas on the district are two in number, both being 24-inch. One governor is sufficient for our present requirements; the other being retained as a stand-by. They are alternately put to work at intervals so as to keep same in good order.

I cannot claim to be able to show the members anything very striking or novel in the way of gas manufacture or plant; but those who care to come will be sure of a hearty welcome, and will be shown all there is to be seen.

In conclusion, I should like to crave your indulgence for any shortcomings in this address, and make as my excuse for same the existing anxious and worrying times. It is difficult for any one at the present time to sit down and concentrate his thoughts in any particular direction, and I have found this to be the case in getting out the few particulars which I have had the pleasure of putting before you to-day.

After the address,

Mr. R. G. SHADBOLT (Grantham) said he should like to propose a hearty vote of thanks to the President for his address, and more particularly on account of the exceptional circumstances under which it had been written. It was a most difficult matter to settle down, and concentrate one's thoughts on technical matters, in such a time as this. How Mr. Farquhar had managed to collect and bring before the members so much of interest as he had done that day, he did not know. He must have had himself well under control, and must be the possessor of a large amount of will power; otherwise his address could not have been prepared. It touched on matters of vital importance at this time, and many of vital interest at any time. One thing they might congratulate themselves upon was that, in spite of the unfortunate war, the members had been privileged to come together in such numbers, as they had done that day. The least they could do, in such exceptional circumstances, was to mark by a very hearty vote of thanks the manner in which their President had risen to his duties in the preparation of the address, and in looking after the interests of the Association.

Mr. J. T. JOLLIFFE (Ipswich) seconded the motion, which was cordially passed.

The PRESIDENT said he was extremely obliged to the members for their vote of thanks. He had done his best in the position in which they had so kindly placed him; and if he had come up to one-half of what they had expected of him, he felt he had done something. He was pleased to hear that the address met with the approval of the members, which added to the pleasure he had had in preparing it and in submitting it to them.

FACTORY LIGHTING: HIGH-PRESSURE INSTALLATIONS.

Mr. A. E. BROADBERRY (Tottenham) then read a paper on the above subject. It was illustrated by lantern slides of a unique series of photographs of factory lighting; and alone was well worth a meeting of gas men. It is published on pp. 271-8, together with a report of the discussion which followed.

The PRESIDENT proposed a hearty vote of thanks to Mr. Broadberry for his excellent paper; and he hoped that he would accept this vote as also conveying the great appreciation of the members of the trouble he had taken in connection with the photographs and the data he had placed before them.

Mr. F. W. CROSS (Lea Bridge), in seconding the motion, said he hoped that the factories on the boundary of his own district would benefit by what Mr. Broadberry was doing on his side of the border.

Mr. BROADBERRY, in reply, thanked the members for the vote and their appreciation, but he must hand over a very large part to Mr. Whyte (of the James Keith and Blackman Company), for what he had done in the preparation of the photographs.

OFFICE-BEARERS AND A NEW HON. SECRETARY.

The PRESIDENT proposed that Mr. A. E. Broadberry be elected President for the coming year. There was not anything he could say regarding Mr. Broadberry that the members did not already know. He was well known to everyone present; and he (Mr. Farquhar) felt highly flattered at being succeeded by such a worthy and eminent man in the gas profession.

Mr. R. G. SHADBOLT, in seconding, said that Mr. Broadberry had placed them under a great debt of gratitude at different times; and they had had a further taste of his quality that day. His election to the chair was the best acknowledgment they could make of the excellent services he had rendered in the past.

Mr. BROADBERRY thanked the members for the honour they had done him in making him their President. They might rely upon him doing his utmost in upholding the prestige of the Association, and in doing everything he could to further its interests.

Mr. J. W. AUCHTERLONIE (Cambridge) proposed as Senior Vice-President Mr. John Terrace, of Grimsby, and Mr. J. H. Brearley, of Longwood, as Junior Vice-President.

Mr. E. W. SMITH, in seconding, said Mr. Terrace was well known to his southern friends, as well as to a great many of his northern friends. It seemed very proper, having at one time been with Mr. Broadberry at Tottenham, that Mr. Terrace should in course of time follow that gentleman in the presidential chair. Mr. Brearley was also known to the members.

The motion was heartily carried.

Mr. TERRACE, in acknowledging his election, said it was unfortunate that, during part of his residence in the Eastern Counties (mainly through geographical circumstances, and others over which he had no control), he had not been able to devote as much time to the service of the Association as he should have liked to have done; but, since he had been a member of the Committee, he had felt that he must pay, and he had paid, more attention to the work. He could, at the same time, assure the members that he had very much at heart the interests of the Association. He was indeed pleased to be again associated with his old chief, Mr. Broadberry, although in a different sphere of work; and he should render him all the support he could during the coming year.

The HON. SECRETARY proposed that Mr. Paternoster be elected Hon. Secretary and Treasurer. From this, the members would gather that he (Mr. Davis) was about to resign the office. He was asking the members to relieve him of the duties—not because he wanted to get rid of them, but because he did not think it fair, under the conditions of his acceptance of the office, that he should keep a younger and more energetic member from it, and one who would take as strong an interest in it as he had done. In Mr. Paternoster, they had a young man who would make an excellent Secretary. He (Mr. Davis) should like now to express his feelings of gratitude for the great courtesy and kindness the members had extended to him during the time he had held the honourable position. He much liked the work; but he did think that the time had arrived when it should be handed over to a younger member. Through his occupancy of the office, he had made a host of friends. He had come in contact with gentlemen whom he would not have known had he not been Hon. Secretary of the Association. He thanked all the members most sincerely for their kindness to him, and for the very courteous remarks they had many times made regarding his services.

Mr. T. A. GUYATT (Ely) said he might claim to have some knowledge of the duties attaching to the office—having occupied it previous to Mr. Davis. He was sure that in Mr. Paternoster they had a man who would carry on the duties to the great satisfaction of the members.

The motion was unanimously carried.

Mr. PATERNOSTER, in acknowledging his election, said that, with the help of the new President and Vice-Presidents, he should be pleased to do all he could to further the Association work.

The PRESIDENT said as one member of the Committee was moving up to the Vice-Presidency, and another one was retiring, there were two new members to elect.

Mr. TROUGHTON moved that Mr. C. F. Veevers, of Northfleet, and Mr. J. Davis, of Gravesend, be elected as members of the

Committee. The members did not want to lose the services of Mr. Davis; and so they were securing the benefit of his advice and assistance through his membership of the Committee.

Mr. E. W. SMITH seconded the motion, which was cordially carried.

Both Mr. VEEVERS and Mr. DAVIS acknowledged their election.

Moved by Mr. DAVIS and seconded by Mr. PATERNOSTER, the Hon. Auditors (Messrs. W. Beale, of Royston, and W. Brown, of Brandon) were reappointed.

A VOTE OF THANKS.

Mr. W. D. CHILD (Romford) proposed a vote of thanks to the President, and to the officers who had worked with him during the past year, for the services they had rendered to the Association. The President himself had laboured admirably, and had done good work. He had been successful also in securing, by his influence, the co-operation of the members of the Association, and he had brought matters of great interest before the members at this meeting. They must also express their indebtedness to the retiring Secretary, who had for some years conducted the affairs of the Association with tact, energy, and courtesy.

Mr. CROSS, in seconding, congratulated the President on the number of members present at this meeting considering the trying pressure of the times.

The motion was cordially passed.

The PRESIDENT sincerely thanked the members on behalf of his colleagues in office and himself. The past year, he said, had been rather a peculiar one; and the work of the Association had been more or less disturbed. He was delighted to see so many members present on this occasion.

PLACE OF NEXT MEETING.

The PRESIDENT remarked that, under the circumstances of the times, there was a little difficulty about arranging just now as to the place of the next meeting; and therefore he suggested they should leave the matter in the hands of the Committee to make the necessary arrangements.

The members signified their approval; and the proceedings terminated.

On Friday a number of the members journeyed to Ilford to inspect the President's works. There was no formality about the visit. As a matter of interest in connection with the occasion, we place on record the following short illustrated description of the arrangement of the plant.

VISIT TO THE ILFORD GAS-WORKS.

Next day a small party of the members accepted the President's invitation to visit his works at Ilford. The number would have been greater had it not been for the anxiety of some to return home in view of the appearance of Zeppelins over certain of the towns in the Eastern Counties. However, those who attended were conducted over the works by Mr. Farquhar, and appeared to be interested in everything they saw. It may be mentioned that a description of the works was given in the "JOURNAL" on the occasion of the visit of the London and Southern District Junior Gas Association in the autumn of 1908 [see Vol. CIV., p. 482]; and beyond the fact that the water-gas house has been completed, and a slight alteration made to the scrubbing and washing plant and a new set of purifiers added, the works are practically the same as then described.

THE WATER-GAS HOUSE, EXHAUSTER, BOILER, AND PUMP HOUSES; ALSO THE COMPANY'S PRIVATE WELL, FROM WHICH ALL THE WATER FOR THE WORKS IS DRAWN.

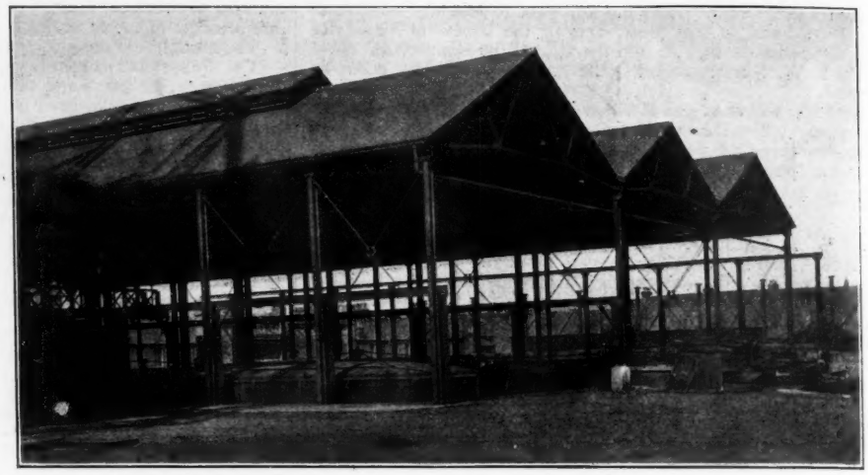
THE YARD, LOOKING SOUTH, SHOWING THE RETORT-HOUSE AND WATER-GAS HOLDER.

The Workshops.

The party first inspected the carpenters' shop, the chemical laboratory, the smiths' shop, and the machine shop. The first and the last are roomy buildings, and are equipped with modern machinery for drilling, grinding, punching, and shearing, and the carrying-out of other incidental work necessary in a gas-works. When it is mentioned that practically the whole of the repairs and the erection of plant and steel buildings are carried out by the Company's own men, some idea may be formed of the completeness of the workshops.

The Gas-Making Equipment.

The party then proceeded to the retort-house, and the general process of getting the coal from the barges into the stores, from the stores into the hoppers, and finally into the retorts, was fully described. Passing from the retort-house, the sulphate of ammonia plant was next inspected, and from there a visit was paid to the boiler, pump-room, and exhauster-house. The scrubbing plant, to which attention was next given, consists of two Livesey and two Cockey washers and a Holmes and a "Standard" scrubber. Foundations for a duplicate set, capable of dealing with 2 million cubic feet of gas, are in position all ready for the plant.

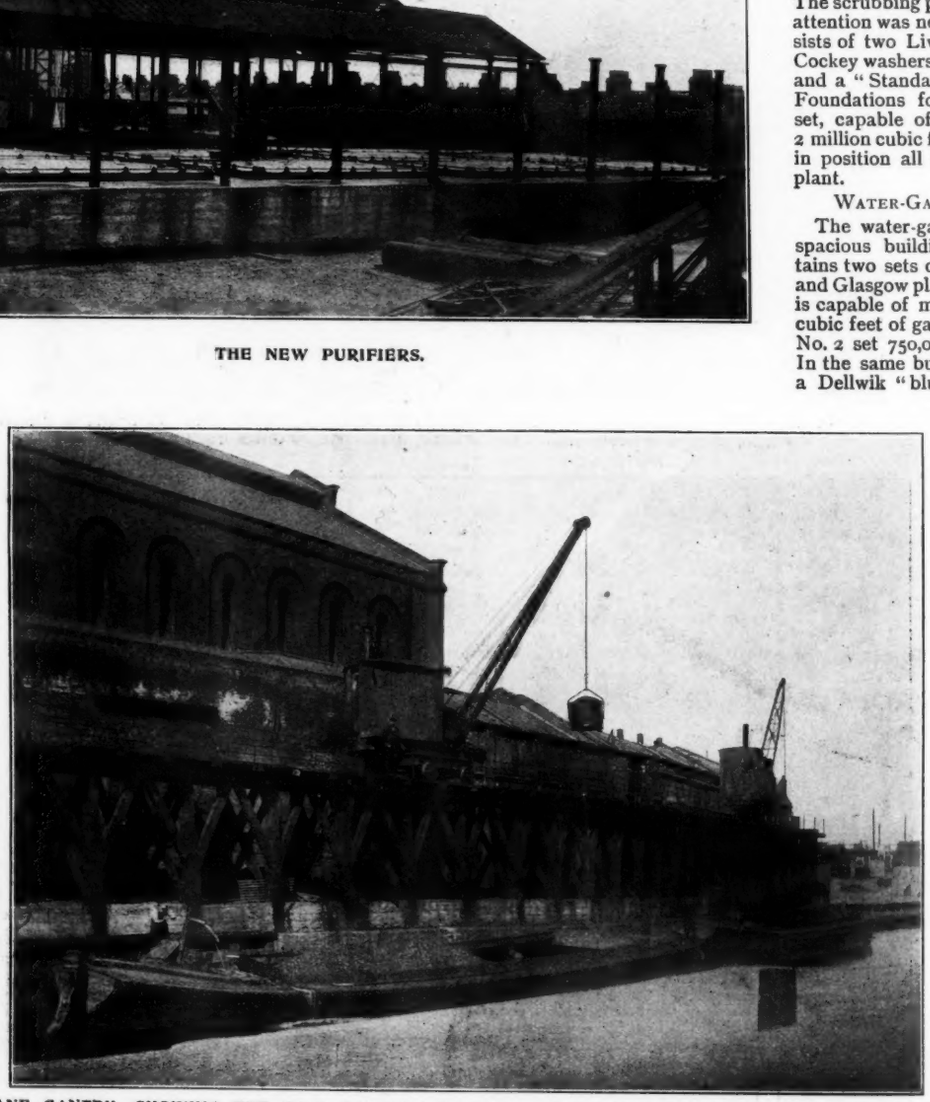


THE PURIFIER HOUSE, SHOWING THE NEW PURIFIERS BEYOND—PREVIOUS TO THE ERECTION OF THE ROOF OVER SAME.

THE NEW PURIFIERS.

Water-Gas Plant.

The water-gas house is a spacious building, and contains two sets of Humphreys and Glasgow plant. No. 1 set is capable of making 650,000 cubic feet of gas per day, and No. 2 set 750,000 cubic feet. In the same building there is a Dellwik "blue" water-gas



CRANE GANTRY, SHOWING THE COAL UNLOADING—TAKEN FROM THE OPPOSITE SIDE OF THE RIVER

plant, which is not at present in use. The turbine blowers and the oil pumps are contained in a building erected inside the water-gas house. Sufficient room has been left in the house to contain four sets of carburetted water-gas plant, each capable of dealing with a million cubic feet per day. The oil storage consists of two reservoirs, the capacity of each being 60,000 gallons.

The Purifiers.

The party then inspected the purifiers. Those for the water gas consist of a set of four, 20 feet square; the coal-gas purifiers consist of two sets. In No. 1 there are four boxes 24 ft. by 27 ft. 6 in. by 5 ft.; and in No. 2 there are also four, 30 ft. by 27 ft. by 5 ft. 6 in. The purifiers are built on columns, and the oxide is discharged from doors in the bottom of the boxes on to the floor beneath. The second set of purifiers has only been in use about six months.

Meter and Governor Houses, &c.

The party inspected the meter-house and governor-house, and also paid a visit to the meter-repairing shop and the gas-testing room. The Company have erected a model shooting-range for the employees; and this was also shown to the visitors.

THE RECOVERY AND FRACTIONATION OF BENZOL FROM COAL GAS.

By W. Diamond, of Marley Hill.

[A Paper read last Saturday before the North of England Gas Managers' Association.]

The subject of the recovery of benzol and its fractionation is not a new one; but owing to the present-day conditions and requirements of our War Office, it has become of more special interest, as the ultimate finished article or substance T.N.T. is composed largely of toluol, produced by distillation of coal and recovered from the coal gas and tar by absorption and distillation. A very considerable quantity of benzol is recovered from the coal gas generated by the bye-product coke-oven, by absorption by a suitable absorbent.

Aims of Coke-Oven and Gas-Works Carbonization.

The working of bye-product coke-ovens and gas-works retorts has two opposite objects. In coke-ovens, the manager aims at producing as much coke of the best quality as possible, at the same time stripping the gas of all its valuable contents, and with the residuum either generating steam, after heating the ovens, or dividing the gas and using part for power and part for heat in gas engines and ovens respectively. The gas-works manager endeavours to produce as much gas as possible, of either a high illuminating power or calorific value, per ton of coal carbonized, and of uniform quality. So that, on considering the two grades of gas, one finds that the coke-oven gas need not necessarily be of an exactly uniform quality, and is generally poorer in calorific power than retort-gas. On the other hand, owing to public requirements, the retort-gas is uniform, and has a fairly consistent calorific and illuminating power, which may be relied on for use in gas-engines and for lighting. The gas from coke-ovens may have a calorific value ranging about 400 to 450 B.Th.U., perhaps sometimes higher or lower—I have known of both. The retort-gas is about 600 B.Th.U. The reason of this difference is very clear; but it is not within the scope of the present paper to deal with it. I mention this side-issue because, as will be seen later, the effect of stripping the gas of its benzol content greatly affects its calorific value.

Content of Benzol in Coal Gas.

The content of benzol in coal gas manufactured by the coke-ovens is very consistent for the coal carbonized, but varies in different seams, and more especially from county to county. The following list shows the result of large workings in different counties.

County.	Seam.	Benzol Content per Ton of Coal Carbonized. Gallons.
South Yorkshire	Barnsley	3
	Parksgate	2·5
	High Hazel and Flockton	3·5
Derbyshire	Black Strall Main and Tupton Seam	2·5
	Flockton and Parkgate	3·0
Shropshire	Flint and Clod	3·08
Durham	Busty, Hutten, and Brockwell	2·1
		2·5

It will be seen from these figures, that the content of benzol in the coal gas increases as we go South—Shropshire and Derbyshire showing about the limit. These tests are all based on one quality; so that they are quite comparable. I would mention that the term benzol does not specify any definite substance or compound, but simply the liquid recovered from coal gas and tar, which on distillation yields a definite quantity of distillate at the required temperature. The general specification is that the benzol shall, on distillation in the retort, yield 65 per cent. distilled up to 120° C. This may, as I have said, be altered to suit requirements and still be called benzol. Broadly speaking, benzol consists of benzene and its homologues, benzene, toluene, xylene, naphthalene, carbon disulphide, &c., in varying proportions; but nevertheless it is the chief source of the refined products. The naphtha from coal tar most decidedly is another source, but not so great to-day as it was—*i.e.*, per ton of coal—25 years ago, owing to the higher temperatures obtained in the retorts. Where gas undertakings had the old settings without regenerators, the tar contained a much higher percentage of naphtha; the gas also, I believe, contained more.

Recovery.

For the purpose of recovering benzol, it is necessary to have a series of scrubbers similar to those used for absorbing ammonia from coal gas. The scrubbers may be filled with coke, boulders, earthenware balls, or wooden grids. The last is, I think, the best filling, because it is more easily cleaned when required, and offers less back-pressure with a maximum efficiency. There are also required circulating pumps and store tanks. The scrubbers are fixed after the ammonia scrubbers—that is to say, the gas, after cooling, passes through the ammonia scrubbers and then directly through the benzol scrubbers. A good quantity of wash oil or absorbing oil is required. This generally consists of well-settled coal-tar creosote oil. A very suitable oil—one that has a great affinity for benzol—gives the following result, approximately, on distillation:

Degs. C.	Per Cent. Distillate.	
200 ..	*Nil*	
220 ..	20	Specific gravity, 1·040 at 60° Fahr., containing 8 per cent. of tar acids.
240 ..	35	
260 ..	65	
280 ..	75	
300 ..	85	

Sometimes blast-furnace creosote or shale oil is used. An average sample of blast-furnace creosote yields on distillation:

Degs. C.	Per Cent. Distillate.	
240 ..	9	Specific gravity, ·980 at 60° Fahr., 25 per cent. tar acids.
260 ..	30	
280 ..	50	
300 ..	65	

The preference for using coal-tar creosote is due to the possibility of the benzol becoming more polluted with paraffin when using blast-furnace creosote. In order to recover the maximum quantity of benzol, the wash-oil must be kept in as uniform condition as possible; only a very narrow range should be allowed in the specific gravity. By the continuous circulation, heating, and distilling, the wash-oil gets thicker every hour, and eventually will become so thick as to have hardly any affinity for benzol. Consequently, if one used such oil there would be considerable loss; so that if a range from 1·040 to 1·060 specific gravity be allowed the circulating wash-oil, one would be assured of receiving the best results. When the wash-oil reaches 1·060, it ought to be taken out of circulation and new oil pumped in. An experiment I made with oils of different qualities gave the following results: Coal-tar creosote, 0·22 gallon; filtered anthracene oil, 0·043 gallon. The apparatus, rate of flow, &c., were uniform. Both experiments were carried out at the same time.

Another factor which very greatly interferes with the quantity of benzol absorbed by the wash-oil is the amount of water contained in the wash-oil. This may be added water, or water carried over by the gas from the ammonia scrubbers. Whichever it is, it should be at once removed or brought down to within 1 per cent. The water forms an emulsion with the wash-oil which is difficult to separate, and causes endless trouble by absorbing inorganic acids from the gas which attack the ironwork, either cast or wrought, of the plant. I have known wrought-iron coils to last only three weeks. The effect in cast iron is not so severe; but the acids do eventually go through that.

In the following test which I made the influence on the absorption will be clearly seen:

	Gallon.
Coal-tar creosote free from water	0·22
,, ,, 2·5 per cent. water	0·14
,, ,, 5·0 ,, ,,	0·14
,, ,, 7·5 ,, ,,	0·12
,, ,, 10·0 ,, ,,	0·06

When the quantity of water becomes 10 per cent. and over, the results are irregular; but below this the results seem regular. It is, of course, necessary that the lowest possible temperature to which one is able to reduce the gas should be used, as the lower the temperature of the wash-oil and gas the greater the affinity. When the gas is brought down to under 60° Fahr. and the wash-oil is reduced to about 32° Fahr., the increase in absorption is about 20 per cent.; but to do this the cost, at present-day prices of refined products, is prohibitive. If the gas rises above 75° Fahr. there is considerable loss—that is, supposing the oil to be at 75° Fahr.—so the happy medium is the most profitable.

The gas now having been stripped of benzol, the wash-oil is sent to the distillery, where the benzol is separated from it. There are two classes of stills—the intermittent or pot still, and the continuous still.

The Intermittent Still.

The intermittent still is a large cylindrical tank having a capacity of 30 to 40 tons, with a dome top and vapour outlet. The vapour outlet is fitted with a cast-iron swan neck, which leads to a condenser and receivers. Inside the still there is fitted a

2-inch wrought-iron coil the full height and circumference of the still, which is coupled to a steam-main and at the bottom to a steam-trap. There is also lying across the bottom inside a single pipe, which is closed at one end and coupled to the steam-main at the other. In the part lying across the bottom there are innumerable ¼-inch perforators. The usual sludge, &c., valves are fitted. The only drawback to this kind of plant is the large ground space required, and the considerably larger quantity of wash-oil in storage. They have distinct advantages over the continuous process in some ways; but the continuous plant is the one in general use at the present time.

Continuous Still.

Continuous stills are of varied design; but, broadly speaking, they consist of preheater, heater proper, and still coupled to the condenser and receivers. The heaters may be chambers fitted with internal steam-coils to raise the wash-oil to the required temperature. The preheaters are also condensers, in so far as the cold oil from the scrubbers is heated by the debenzolized oil from the still and *vice versâ*. The still should consist of a bottom chamber and a vapour outlet on the top, coupled to a series of circulating trays, fitted one on the other, of about 3 feet diameter and 12 inches in depth, with a luted seal inside, over which is placed a toothed cap or cover. The surplus condensate in each tray is carried to the next lower tray by means of a short pipe, and eventually is conducted into the still. Inside, and along the bottom, of the still is fitted an open steam-pipe, as in the intermittent type. The number of trays in the column is decided by the requirements of the refiner. The top tray is fitted with a 4-inch outlet pipe, which is coupled with a condenser. The condenser may be of any preferred type, but must be absolutely tight. The outlet pipe from the condenser is coupled to a separator, in which are separated the water and benzol which have been vaporized in the still and condensed in the condenser. These separate by their own gravity, and are conducted to where they are required.

The continuous process for the production of crude benzol is as follows: The new wash-oil is pumped out of its store-tank into the base of the last scrubber, and is from there pumped by another pump to the top of the same scrubber, and counterflow to the gas. As the wash-oil is being continually pumped into the scrubber the same rate of flow of benzolized oil goes over the seal into the base of the next scrubber, and, after circulating there, gravitates to a tank which is termed the benzolized oil-tank. A third pump now draws it through a pipe through a superheater. This is formed by two pipes—a smaller inside a larger one. Through the inner pipe is drawn the benzolized oil, and surrounding it flows the debenzolized oil from the still. After this interchange of heat, the benzolized oil is drawn through the heater proper, where it is heated to about 130° to 140° C., and then forwarded into the still. The vapours and steam ascend the column, and are fractionated somewhat by the baffling in the trays by the bonnets. The mechanically carried stuff, of course, is caught by the inspringing of the vapours in the trays on the bonnets, and there, together with the higher boiling benzols, gravitates through the seal-pipes down the column into the still. The lighter vapours find their way into the condenser, are condensed, and find their way into the separator, and so forward to the store-tank.

From the benzol outlet a sample is taken and tested in the laboratory. If it should be found to be above 65 per cent., or any desired strength, a little open steam is admitted in the still, which helps to liberate the higher boiling homologues and weakens or lowers the percentage quality of the distillate. Should the benzol not be of sufficient strength or quality, the wash-oil is circulated through the scrubbers for a longer period, and afterwards only heated to a much lower temperature, and no open steam admitted, so as to liberate the lower boiling products. From time to time samples are taken and tested, and the plant regulated according to the result of the test. A distillation test of crude benzol is as under:

Specific gravity	·898	
at 110° C.	37	per cent. distillate
120° C.	65	,, ,,
160° C.	78	,, ,,
190° C.	85	,, ,,

This is the product from which we obtain all the refined products of benzene, &c. But it is quite impossible to obtain them by a single fractionation; the crude benzol must be refined as much as possible. To do this it is run into a pot-still, fitted with a column in the vapour outlet similar to the wash-oil still; but inside this still is fitted a steam-coil, also an open steam perforated pipe. There is also the requisite condenser, receiver, and separator. Steam is put into the coil, and the intermediate benzol is heated; the vapours passing through the column as previously described, condensed, &c. This coil is kept hot as long as any distillate comes over. The residue is tested when this ceases and tested to 190° C. If there is any distillate under this temperature, open steam is admitted and carried on until by test the residue is shown to contain no distillate under 190° C. The residue is now run into cooling tanks, and when cold disposed of as creosote salts or any convenient requirement. By this distillation the product will have become considerably refined, as is shown by the following test:

at 100° C.	63	per cent. distillate
110° C.	74	,, ,,
120° C.	80	,, ,,
160° C.	89	,, ,,

Washing and Fractionation.

The next processes are washing and fractionation. The materials required for washing are rectified sulphuric acid, caustic soda, and water. The washing apparatus consists of a square or cylindrical tank, with dished or conical bottom, and may be made of wood or iron, lined with ⅛-inch lead, with as few joints as possible. The bottom is fitted with an outlet pipe and cock. The top is also covered as far as possible. Inside the vessel is fixed an agitator or stirrer. A very good design consists of a short-twist cast-iron worm, which works inside a conical tube, the edges of which are toothed. This is then fitted with gearing and mechanically driven; so that when the washer is full and is started the liquid inside the conical tube is carried down by the worm, which is revolving, and so causes the surrounding benzol to overflow into the tube at the top. This gives thoroughly good mixing in a minimum of time. There are many other designs; but the one I have tried to describe is the best I have seen. Our object now is, putting it crudely, to wash out of the intermediate benzol all the tarry matter and as much sulphur, which is contained in the benzene as thiophene and carbon disulphide, as possible. Benzol containing before washing 0·41 per cent. of carbon disulphide and 0·46 per cent. of throphene was reduced after washing to 0·23 per cent. and 0·17 per cent. respectively.

There are innumerable other impurities, including phenols, which are absorbed from the benzol by the caustic soda. The quantities of chemicals to be used in each washing are approximately estimated in the laboratory in order to obtain the best results, also to prevent waste of chemicals and benzol. We will suppose the washer to contain about 1000 gallons of benzol, and that by experiment we have found that it will require 8 per cent. of acid to clear the benzol of impurity. The process is then as follows: About two buckets—say 6 gallons—of dilute caustic soda solution are poured into the washer, and the agitator is started and allowed to run for about 10 minutes. By this time the caustic will have combined with the phenols, and the whole is allowed to settle, and the caustic is afterwards drawn off at the bottom. Very great care must be used in seeing that the washer is quite free from water. If there is the slightest trace, it must be drawn off. To obtain the best results, the acid that is required (8 per cent.) is run into the washer in three portions—3 per cent., 3 per cent., and 2 per cent. After adding the first 3 per cent. the whole is agitated for half-an-hour, is allowed to settle, and is then drawn off. If too little has been added, the tar acid will be hard and thick; if too much, it will be thin and limpid. So that one must be guided. A second 3 per cent. is added, agitated, and drawn off, and the remaining 2 per cent. is added. A considerable time is then allowed for the benzol to settle, in which the acid tailings are deposited and afterwards drawn off. After making sure that the benzol is clear of free acid, water is added (about 50 gallons), is agitated, and then drawn off. It will be noticed that the water is coloured red. A second addition of water is made, agitated, and drawn off. The benzol ought now to be clear of tarry matters—*i.e.*, pyridine bases, &c. The sulphur compounds being reduced to a considerable extent, the remainder of the refining is to take place in the fractionating still. It is quite necessary to have some idea of the boiling temperatures of the constituent parts of the benzol. Approximately they are as under:

Deg. C.		Deg. C.	
80	to	82	Pure benzene.
82	,,	110	Mixtures.
110	,,	112	Pure toluene.
112	,,	137	Mixtures.
137	,,	140	Pure xylene.

These are the chief constituents; but it is impossible to separate them by one fractionation. In order to simplify the final fractionation, the washed intermediate distillate is distilled in a still as shown, which is exactly the same as is used in the final fractionation. The distillates are controlled so as to produce either:

(1) 90 per cent. benzol, 50-90 per cent. benzol, solvent naphtha;

(2) 90 per cent. benzol, 90 per cent. toluol, 90 per cent. solvent naphtha.

The first means that in testing it will yield 90 per cent. up to 100°, the 50-90 means 50 per cent. of distillate at 100° C. and an additional 40 per cent. at 120° C., and the solvent naphtha 90 per cent. distillate up to 160° C.

A very good guide to work the still by is to distil off the benzol in a side tube flask, fixing the bulb ½ inch below the side tube. The side tube is coupled to a condenser, and so on. Separating the fractions at 100°, 120°, 160°, and 190°, it will be found that the works results and the laboratory test thus made agree fairly well. The composition of the 90 per cent., 50-90 per cent., and solvent naphtha is approximately as under, from which it will be seen that there is a considerable quantity of toluene in the 90 per cent., and also that the 50-90 per cent. consists largely of toluene, and there is a trace in solvent naphtha:

	90 per Cent. Benzol.	50-90 per Cent. Benzol.
Pure benzene	79	.. 19
Toluene	8	.. 24
Xylene	2	.. 10

The composition of benzols as used in colour work is given by Kraemer and Spilker as under:

—	95 per Cent.	50 per Cent.	0 per Cent.
Water	0·060	..	..
Paraffin	0·100	0·25	0·50
Carbon disulphide	0·686	0·39	..
Substances absorbing bromine, including thiophenes and the like	1·202	1·23	0·82
Thiophene pure	0·264	..	..
Benzene	80·922	45·37	13·54
Toluene	14·855	40·32	73·42
Xylene	2·180	12·44	11·69

I wish here to point out that the word toluol is similarly used as the word benzol. Toluol covers all products which in the distillation of benzol boil between the temperatures of 100° and 120°. Toluene is a definite chemical substance, its formula is $C_6H_5CH_3$, and it has a definite boiling-point of 111° C. Benzene is likewise a definite chemical substance, having a formula of C_6H_6 and boiling-point of 82° C. Any variation of these temperatures denotes impurities. Having for a guide the results of the distillation test of the washed benzol the still is charged, and our intention is to produce 90 per cent., 50-90 per cent., and solvent naphtha. The dry steam in the still is admitted as already described, which vaporizes the lighter benzols. When there is about the quantity distilled over, as shown in the laboratory test, a sample is taken out of the store-tank and tested. If the result of the test shows that the stock is (say) 95 per cent., the distillate is carried on until a sample yields as near 90 per cent. as possible. More often than not it is inconvenient to work to this figure; so when the test is about 90 per cent. the receiver is changed into the 50-90 per cent. store-tank, and all that will volatilize by the steam coil is distilled into it. Afterwards, to bring either the 90 per cent. or the 50-90 per cent. to its proper or definite quality, is easily done by the addition of a quantity of one to the other.

The stuff now left in the still consists of solvent naphtha and creosote salt. In order to get the solvent naphtha out of the mixture it is necessary to admit open steam. The solvent naphtha is not sent through the column, dephlegmater, and the condenser, as are the benzols; but there is fixed upon the still a 6-inch cast-iron pipe with a valve intermediate between the still and the pipe. The pipes then connect to another condenser, receiver, and store-tank. When steam has blown the solvent naphtha over, the steam is turned off and the residium is run into cooling pans. It is not possible to separate the pure benzene, toluene, and xylene from these by one fractionation; but a relatively pure substance may be procured by distilling the above products—in this case using the dephlegmater.

A dephlegmater is a wrought-iron vessel, about 10 feet long and 2 ft. 6 in. diameter, having two side tubes fitted (say, 4 inches diameter each), and a top and bottom pipe on each end. The top side tube is 1 foot from the bottom, 2 inches above the side tube; and 2 inches below the bottom one are fitted steel plates bored with as many 3-inch holes as possible into which are fitted tubes, coupling the top and bottom plate—thus dividing the vessel into three compartments. The vapour pipe from the still column is coupled to the top side pipe, and the bottom side pipe coupled to the condenser immediately above the bottom plate. There is fitted into the side a 2-inch pipe in the form of a seal, the other end being coupled to the still or column. Either air or water is used in the dephlegmater– it depends upon the size and efficiency of the apparatus and other things. Whichever is used (say, water), it passes through the ¾-inch tubes and escapes through the 4-inch outlet at the top. In the vapour pipe and the dephlegmater thermometers are fitted.

So then, having control of the dephlegmater, we continue the separation. In this case, our purpose is to separate the benzene and toluene. The boiling-point of benzene is lower than that of toluene, so benzene is recovered first. To do this, the temperature of the dephlegmater is maintained at about 78° C. Products boiling at under this temperature pass through condensed, and are delivered to a separate store tank. The temperature is raised in the dephlegmater a few degrees, the vapours now passing being approximately pure benzene. When the condensate ceases, the temperature in the dephlegmater is again raised (say) to 105°, and in like manner the benzene manipulation is carried out, and approximately pure toluene is produced, and the xylene in the residue is likewise recovered. To obtain the quite pure substances, each of the above products is separately distilled in the same apparatus with the dephlegmater very carefully controlled. Particular attention also is paid to keeping the products free from moisture. I have found in working the moisture to make 1 per cent. difference the final products must each boil within 0·6° or 0·8° C. of their two boiling points.

In all this work there is loss, which is unavoidable. At the commencement, in distilling the crude 65 per cent. benzol, to rid it of naphthalene, there is a residue of about 15 per cent., and a vapour loss of about 2 per cent. In washing, the loss—that is, the quantity of impurities absorbed by the alkali and acid treatment—will vary according to the quality of intermediate benzol put into the washer.

With benzol testing 77 per cent. at 120° the loss is 8·7 per cent.
" " " 87 " " " " " 3·1 " "

These figures will vary with different benzols. In the distillation of the washed intermediate benzol there is a loss of from 1 to 2 per cent. These losses are caused by incondensable gases or vapours passing over the condenser. Altogether we have a total loss of about 11 to 12 per cent. with the lower, or 77 per cent., benzol. From the distillation of two lots of benzol of 1500 gallons each, the results obtained were:

	Per Cent.		Per Cent.
Produced	87 benzol	..	77 benzol
90 per cent. benzol	75 yield	..	58 yield
50-90 per cent.	10 "	..	10 "
Solvent naphtha	8 "	..	12 "
Creosote	6 "	..	9 "
Loss	1 "	..	1 "

In washing, as I said before, our object was the removal of the tarry impurities and the sulphur compounds. These two easily-spoken definitions cover a multitude of substances; but the chief impurities contained in the acid tar are the pyridine series of products C_6H_5N, which it is useless for me to enumerate. Of the sulphur compounds the chief are thiophene and carbon disulphide —C_4H_4S and CS_2 respectively. In order to obtain a product quite free from the sulphur compounds many experiments on the laboratory and manufacturing scale have been carried out. Some that suggest themselves are washing with a solution of aluminium chloride, as devised by Waller and Michel, which converts the sulphur into sulphuretted hydrogen; also washing with alcoholic potash, which absorbs CS_2. But they are not successful technically. It is found that the best results are obtained by skilled washing with rectified sulphuric acid. The sulphur content varies in different coals as is shown under:—

	C_4H_4S.		CS_2.
Durham Busty, Brockwell, and Hutton	1·58	..	0·230
Derbyshire	1·63	..	0·176
Shropshire	1·68	..	0·394

I do not wish it to be thought that this is the only system that can be adopted for the manufacture and recovery of benzol products. There are little differences in manipulation which is the pet fancy of each manager—I am sure with the object of increasing his yield, and in which he very probably succeeds.

Calorific Value.

At the beginning of the paper I remarked that the calorific value of gas was considerably affected by absorption of benzol from it. This difference will vary according to the coal carbonized, also to the efficiency of the absorbent. That is to say, if the quantity of benzol recovered per ton of coal is only about 2 gallons, the difference is not so great as when 3 gallons are absorbed. The following actual results have been recorded:

2·1 gallons benzol recovered per ton of coal entails a loss of 4·5 per cent.
2·5 " " " " " " " 7·0 "
3·0 " " " " " " " 8·0 "

So that on the production of 5,000,000 cubic feet per day the loss is very great. But by producing a gas of 600 B.Th.U. per cubic foot, and allowing for the loss of 8 per cent., we still have a gas of sufficient quality to obtain the best results from incandescent mantles with our present-day burner.

Testing.

The ordinary distillation method adopted in the laboratory is not a sure test as to the content of the benzol, toluene, &c., in the ordinary retort test. One can make 1 or 2 per cent. difference in the percentage distillate by just lowering or raising the thermometer in the liquid, or by having a larger or smaller flame burning under the retort. Therefore I quite agree with many other writers that the test should be modified and brought to more scientific lines. The distillation flask with side tube connected to a condenser is much better; the bulb of the thermometer being fixed at ½-inch below the side tube, and the rate of flow to be about three drops per second. This method has been advocated by many; but as yet it has not supplanted the common retort method.

For the determination of benzene in crude benzene Lunge recommends the nitrification test, which depends upon the production of nitrobenzene—$C_6H_4NO_2$. There is placed 100 c.c. of the sample in a 500 c.c. flask, and a mixture of 150 grammes of nitric acid and about 180 grammes of sulphuric acid are slowly added to it, with constant agitation. The whole must be kept cool. When all the acid mixture is added, the flask is heated for an hour or so. Next allow the whole to settle, and separate the layers by a separating flask. The acid should be very considerably diluted with water, and any oily matter which separates should be collected and added to the nitrobenzene. This should be washed with water, and afterwards separated and distilled up to 150° C. The result can then be calculated—

100 parts of benzene yield 157·6 parts of nitrobenzene
100 " toluene " 148·9 " nitrotoluene

Carbon bisulphide is estimated generally by the method devised by Macagno in 1881. When carbon bisulphide is added to a solution of potash in absolute alcohol, potassium xanthate is formed, according to the following equation:

$$CS_2 + C_2H_5HO + KHO = KC_2H_5COS_2 + H_2O.$$

This alcoholic solution, saturated with acetic acid and treated with a drop of copper sulphate, gives a brownish precipitate of copper xanthate.

1 c.c. of $\frac{N}{10}$ copper sulphate corresponds to 0·00769 of CS_2.

Thiophene (C_4H_4S) is estimated by adding 2 c.c. of benzene to

30 c.c. of methyl alcohol and 10 c.c. of saturated mercuric sulphate solution, the whole agitated and then allowed to settle, and an insoluble compound removed by filtration. Of the filtrate, 21 c.c. (= 0·1 c.c. of the sample) are placed in a litre flask with 350 c.c. of water, 15 c.c. of NH_4HO, 10 c.c. of $\frac{N}{10}$ NCN solution, and five or six drops of KI, and the whole well shaken. $\frac{N}{10}$ silver nitrate is added until a permanent turbidity results. The quantity of thiophene is calculated from the number of cubic centimetres of silver nitrate used.

Mr. E. F. Hooper (Sunderland) moved a vote of thanks to Mr. Diamond for his paper. Perhaps some of them had been able to absorb the products more easily than others. There was a good deal of the Athanasian Creed about this business. He did not know exactly why it was, but there was a great deal of percentages and names and materials talked about which were not there, or were not intended; but he was very glad that Mr. Diamond had made it clear to differentiate between substances which had to be given proper scientific and technical names. They could generally assume that the suffixes all meant a mixture of something. The suffix E.N.E. meant a mixture. Toluene was as simple a substance to analyze as road mud or paper or many other things. When they spoke of toluene, they spoke of a substance which a chemist could scientifically define and could produce and reproduce, and which had some real existence. He would like to discuss the paper somewhat technically with Mr. Diamond; but this was not the occasion for which they were there. He did not think Mr. Diamond would hold he was wrong when he said the extraction of toluene from the normal town coal gas was, and would be, extracted in the same way that the lighter naphtha bodies were extracted from the coke-oven gas. It was a different problem. The toluene was held in the town gas under somewhat different conditions from those in which the toluene was held in coke-oven gas, which he supposed Mr. Diamond had been directly speaking about. He would like to suggest to the author that, to get over a trouble—which he might find, too—in the washing apparatus he sketched there, where they were using strong acid, alkali, and other things, the conical arrangement was an excellent one for agitating; but the speaker found that air agitation from the bottom had caused all the agitation necessary for the chemistry of the acid and the naphtha. The only precaution was to have a trap outside to wash the escaping air, which might contain a certain proportion of the vapour which they did not want to get rid of, and which had no working parts working in the acid liquid. The benzenes which were produced, in this part of the country at any rate, were wonderful, and were certainly various. He had come across benzene, or the so-called 65 per cent. benzol, which was a mixture of most extraordinary constituents. He had had paraffins and olefines; and when they wanted to get down to rock-bottom analysis of the thing, they had not got more than 30 or 40 per cent. of real benzene and toluene which should have been in the product. For the benefit of bye-product commerce he said the purer the material they washed with the better payments the coke-oven people would get for their material. They wanted to get the very best material, satisfy themselves that it suited their own conditions, and then go ahead and not be misled by any specious suggestions.

Dr. G. P. Lishman (Fence Houses), in seconding the motion, remarked that if anybody required information about the benzol industry he did not think there was any better place in the world to go to than Mr. Diamond's paper.

The vote of thanks was cordially passed, and Mr. Diamond briefly replied.

Prohibition of Toluol Exports.—An order in Council dated the 26th ult. adds toluol and mixtures containing toluol to the list of goods the exportation of which is prohibited to all destinations.

Heating and Ventilation.—At the Society of Engineers next Tuesday, Mr. A. H. Barker, B.Sc., will read a paper on "Some Future Developments in Heating and Ventilation." He will emphasize the importance of the science of heating and ventilation, and point out the difficulties in the way of the scientific treatment of the subject. Convection currents and radiant energy will be dealt with; and the separate functions of the engineer, the physiologist, and the hygienist will be indicated. The author will describe some experiments carried out at University College.

Water-Tight Concrete.—In the course of a communication to the American Water-Works Association, Professor Edgar B. Kay stated, according to "Ferro-Concrete," that a wall of concrete may be rendered water-tight by accurately grading and proportioning the aggregates and the cement. For maximum water-tightness, a mortar or concrete may require a slightly larger proportion of fine grains in the sand than for maximum density or strength. In general, it may be stated that in monolithic construction a wet mixture, a rich concrete, and an aggregate proportioned to secure density, will, in the majority of cases, give the desired results. This method is considered to be unquestionably the best to secure water-tightness; and the Professor is not in favour of using waterproofing ingredients or of making surface applications except in cases where they may be required by reason of imperfections in the original concrete.

SOME PRACTICAL ASPECTS OF VISIBILITY.

With the view of introducing a discussion on the subject of visibility at the meeting of the Illuminating Engineering Society last Tuesday, Messrs. Clifford C. Paterson and B. P. Dudding submitted a paper containing notes on some practical aspects of the question.

In the course of their introductory remarks, the authors explained that the term "visibility" was used in its broadest sense—viz., the ability to see an object or part of one. They pointed out that people are accustomed to distinguish with more or less facility the objects they look at each day, and, as a rule, if their sight is not seriously defective, their seeing suffices for all practical purposes. They are therefore generally content to regard visibility as one of those phenomena which require little investigation; and attention is devoted to the provision of sufficient illumination to put beyond doubt the question of good seeing. It is only in certain circumstances, when the illumination is necessarily low, or the power to distinguish objects is interfered with, that it becomes necessary to examine some of the phenomena on which visibility depends.

The opening of the discussion on the subject by the authors therefore took the form of an account of inquiries made by them at different times into conditions which in some practical cases prevented good visibility. The following are some of the questions which engaged their attention and are dealt with in the paper: (1) The visibility of distant lights at night; (2) the visibility of objects illuminated by the beam of a searchlight or motor headlight; (3) the visibility of objects in close proximity to bright lights; (4) the relative visibility of objects by direct and indirect light. The following are some extracts from the paper.

Visibility of Distant Lights at Night.

The authors had occasion, a few years ago, to carry out an investigation into the visibility of point sources of light at sea; and it was found that a definite value of visibility for practical use was 1·6 candles at two sea miles viewed on an ordinary clear dark night. They further found that the inverse square law held rigidly for point sources of light when there was no atmospheric absorption. They also found that the intrinsic brilliancy of the source had no influence upon visibility, but that it is only the total flux of light emitted which counts. Taking two sources of light subtending less than one minute of arc, one of them 1-16th inch diameter and the other approximately 1 inch diameter, both having the same candle power, they will both appear equally visible point sources from a distance of (say) 100 yards. When, however, a source of light or an object becomes large, and subtends an angle appreciably greater than that which corresponds with the resolving power of the eye, the laws given must no longer be assumed to hold.

The equivalent of 1·6 candles at two miles is not the least light it is possible to see under favourable laboratory conditions when the eyes are thoroughly dark adapted. If the light intensity is lowered to about one-quarter or one-fifth of this, it may still be seen, at least intermittently; but the resulting value is on the threshold of visibility by direct vision. It is interesting then to try to estimate quite roughly what is the amount of energy which thus seems to be the minimum which will stimulate a single element of the central part of the human retina. This may be calculated from a knowledge of the shape of the sensitivity curve of the eye at different wave lengths and the average distribution throughout the spectrum. For radiations to which the retina is most sensitive—viz., between 0·52 and 0·58μ and for a pupil aperture of 7·5 mm.—the amount of energy per second from a point source which will just stimulate direct vision when the eyes are dark adapted is found to be of the order of 6×10^{-15} watt. An idea of the magnitude of this fraction of a watt may be obtained if the distance from the earth to the sun is assumed to represent a watt. Then the amount of energy per second which will stimulate vision is represented by a distance of 1 cm. (0·3937 inch).

Visibility of Illuminated Objects at Night.

This aspect of the question was considered by the authors with particular reference to the use of searchlights and motor headlights. The authors were led to the following conclusions regarding visibility and distance: For an object subtending an angle less than about ten minutes of an arc (about 1 foot at 100 yards), the brightness for equal visibility must be proportional to the square of the distance from the observer; but for objects subtending larger angles than this, the brightness for equal visibility must be proportional simply to the distance between the object and the observer. In putting forward this result, the authors point out that it is not in accordance with the usual assumption, but they have not been able to ascertain on what experimental work is based the usual hypothesis, which is that the square law condition governing the visibility of small objects holds also for large ones.

Visibility in Presence of Bright Sources of Light.

The authors say this is merely the much-discussed subject of glare, upon which a great deal has been written and a certain amount of experimental work carried out. What follows is not intended to be a general survey of the subject, but merely some notes and experiments on one phase of it. The original object was to obtain a criterion by means of which the interference with visibility caused by a bright lateral light could be measured.

Two cases were under consideration: (1) The ability to see past an approaching car with bright headlights; (2) the interference with visibility when working in ordinary illuminations with a "light in one's eyes."

The result of the experiments was to show that with the very low illumination prevailing at night, and the consequent dark-adapted condition of the eyes, lights of the projector type very much less intense than motor headlights are sufficient to render it impossible to distinguish any objects at all which are situated behind them. This result was not unexpected; but the authors were surprised to find, from a number of tests made under the second case, with the intention of measuring the diminution of visibility of objects with an equivalent surface brightness of about 2 foot-candles and upwards under severe conditions of glare, that it was difficult to find any diminution of visibility at all. There is no doubt about the annoyance caused to an observer by the presence of bright lights in his field of view; but it appears that his ability to distinguish objects or details is only affected when the brightness of such objects is relatively low. As a matter of fact, a shadow contrast of 5 per cent. at an absolute illumination of 2 foot-candles was entirely unaffected by a glaring light of 20 candles placed 8 inches from it when viewed from a distance of 6 feet. If, however, the equivalent surface brightness was reduced to 0·5 foot-candle, the contrast was entirely obliterated under the severe conditions of the experiment.

The following reading test was carried out by three observers. A page of ordinary printed matter was arranged with a constant illumination of 2 foot-candles at its surface; the lamp producing the illumination being placed close to the page and at a distance of 2 inches from one side of it. The light could be shielded from the eyes at will without changing the illumination at the printed surface. The time was noted which was required by each observer to read aloud, and as quickly as possible, one-half the page of printed matter when the light from the lamp was shining into his eyes, and then the time to read the second half with the eyes shielded from direct light. This was done with several pages of printed matter, with the following mean result:—

Observer.	With Glaring Light.	Without Glaring Light.
A	238 seconds	239 seconds
B	281 ,,	269 ,,
C	259 ,,	287 ,,

It was only when the illumination was reduced very much below 2-foot candles, or when the groundwork of the printed page had a dark tint, that detail tended to become obliterated. These results do not affect the question of the undesirability of glaring lights from other points of view, but merely indicate that it is not easy to discover that glaring lights have very much effect on the visibility of detail under ordinary conditions of lighting.

Visibility of Detail by Direct and Indirect Light.

The discrimination of detail in certain circumstances depends almost entirely either on shadow or on the direction of the incident light. Where the surface of an object to be viewed is uneven but uniform in colour, the only way in which the unevennesses can be shown up is by differences in the illumination of such surfaces caused by the different angles which they present to the incident light. If the unevennesses are very deep, they will be shown up by the shadows which are thrown by the raised portions on to the surrounding surfaces. For instance, the embossed lettering used on some note-paper depends entirely on this action; and a sculpture in bas relief must obviously present a very different appearance according as it is illuminated by unidirectional light at a glancing incidence or by light from a large source striking it mainly at normal incidence.

This question has a wide practical application in the manipulation of self-toned fabrics—viz., unicoloured fabrics with no natural contrasts. One of the authors has for upwards of ten years used indirect lighting for domestic use, and for a long time he ridiculed the often-repeated assertion which was made that it was a most unsatisfactory light by which to do needlework, particularly darning. He has come to see, however, after experiment, that the contention is perfectly sound, and that there is nothing so good as a unidirectional light giving harsh shadows for the discrimination of detail in needlework of all kinds. Indirect lighting, with its soft shadows, is, in the author's opinion, an ideal light for domestic use, except in respect to this one particular.

The Italian Society's Meeting.—The meeting of the Italian Gas and Water Association will be held in Rome on the 14th and 15th inst. The proceedings will not be long; and, in view of the existing circumstances, there will be no reception, banquet, or festivities of any kind.

Extension of British Trade.—In accordance with the terms of a resolution passed at the recent Cardiff conference on the extension of British trade [as reported in last week's number of the "Journal"], a Committee has been formed to consider and report on the different ways in which local industries may be benefited and new industries introduced into the district, on the lines indicated by the various speakers at the conference. The Committee, which is an influential one, includes the Lord Mayor (Alderman J. T. Richards), Mr. Joseph Stanfield (the Chairman of the Technical Schools Committee), and Mr. George Clarry (General Manager and Secretary of the Cardiff Gas Company.)

FACTORY LIGHTING: SOME RECENT HIGH-PRESSURE GAS INSTALLATIONS.*

By A. E. Broadberry, M.Inst.C.E., of Tottenham.

[A Paper read last Thursday before the Eastern Counties Gas Managers' Association.]

At the present time, owing to the huge demand for arms, munitions, clothes, and food-stuffs for the war, many factories are working throughout the night as well as during the day.

The efficient lighting of these works, consequently, has become a matter of extreme importance, and experience shows us that the officials having charge are keenly interested in any scheme which will enable them materially to increase the output of work by means of better lighting of their factory.

That good lighting does increase the output, in my opinion there can be no shadow of a doubt. It enables men to do their work as quickly, as accurately, and (above all) as cheerfully by night as by day. I have put cheerfulness above all, because I think everyone will admit that there is more tendency to despondency when working at night, and despondency is the worst possible state of mind for producing either speed or correctness in any class of work.

Factories which are at the present time working at night—even taking the district of the Tottenham Company as a criterion—are very varied as regards shape, build, and class of industry, and naturally their requirements in regard to ideal lighting must vary for the same reasons. From the nature of their structure or their work, some require general diffused lighting; but in other trades what is usually known as "point," or "spot," lighting is far more important, if not actually essential.

Experience shows that in many of these cases it is quite a usual practice for those in charge to adopt electric lighting on account of the ease with which an electric lamp can be placed in a convenient position beside the machine by means of a flexible wire pendant, rather than from any consideration either of efficiency or economy in cost. The Tottenham Company, in that part of its area where we supply electric current as well as gas, would probably welcome an extension of its electric business by these means; but in the portion where we supply gas only, it is naturally to our interest to push the claims of gas for cheaper and better lighting.

For this reason, I feel that the members will be interested in an extensive installation of high-pressure gas which we have just installed on our district. I think, however, it will be best, in the first place, to give some history of the factory.

In the year 1903, Messrs. Millington and Sons, Limited, the well-known wholesale export and manufacturing stationers, of Budge Row, E.C., built the Crown Works at Tottenham Hale, and have since been users of our gas for lighting purposes; and throughout our business relations with them we have always found them ready to take a broad-minded and business view of any proposals placed before them.

Their works were designed and erected under the able advice of Mr. S. Clifford Tee, of 50, Moorgate Street, who is well known as an expert Factory Architect. From the first introduction of high-pressure gas lighting, he has been an ardent advocate for its use in all the factories for many various trades, for the design of which he has been responsible; and under his advice Messrs. Millington installed the Keith-Blackman high-pressure system, arranged in the general diffused style of lighting.

It is unnecessary for me to remind members that the Keith system, although the best means of gas lighting then known, was far from being what the Keith system is now. It consisted of a water-operated compressor, giving what was then the "high" pressure of 10-inch water column. The burners were mostly of the upright type. The efficiency was only 30 candles per cubic foot per hour.

Looking back to those old days (which, after all, were only twelve years ago) this efficiency, being nearly double that obtainable by low-pressure gas, was considered quite remarkable, and it gave a result in the lighting of the factory which, in those days, was considered highly satisfactory, and was quite unattainable by electricity, using the old carbon filament lamps.

As time went on, extensions and alterations in methods of working created a need for different lighting in the factory, and electricity was adopted. Tungsten filament lamps were used in most cases, and the point lighting system was adopted in certain parts of the works. The advantage of placing the lights in such a position that the illumination will fall on the work just where it is required was naturally greatly appreciated, and for the time being put the consideration of cost into the background.

Last year a very large extension to the premises was carried out, and we learned, with some dismay, that electric lighting had definitely been decided upon for the illumination of the new portion, and that, in all probability, it would be carried throughout the older part as well. With the assistance of Messrs. Keith and Blackman, and with the goodwill of Mr. S. Clifford Tee, the Architect (whose preference for high-pressure gas has already been mentioned), we approached Mr. H. Godfrey, the Managing Director of Messrs. Millington and Sons, and asked to be allowed to place before him the claims of the modern systems of high-pressure gas

* The excellent photographs by which the paper was illustrated were all taken by Messrs. John H. Avery and Co., of Hillmarton Road, N

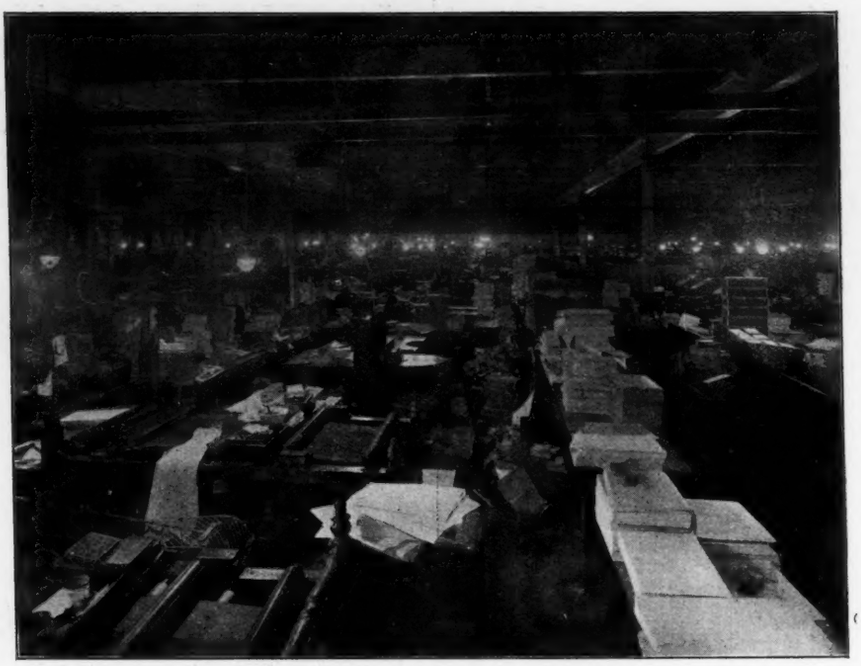


Fig. 1.—MILLINGTON AND SONS' FACTORY.

lighting, both as regards efficiency and adaptability and as regards cost.

With the greatest courtsey and open-minded fairness which, combined with shrewd and determined business acumen, are inherent in his nature, he pointed out that electricity appeared to them to be more suitable for their purpose, and that, as he could produce it at such a cost as he believed placed it entirely beyond the range of competition of gas, they had not troubled to secure any comparison or competition between the two systems. If, however, we cared, at our own risk, to put in a trial installation in the older portion of the factory in place of the original high-pressure system, and if we could thereby demonstrate that either in cost or in effective efficiency gas had superior claims, he would give us leave to try. He added that we might rely on the result being carefully considered, and, if favourable to gas, the lighting scheme for the new portion of the works should be reconsidered. We gladly accepted our opportunity; and Messrs. Keith and Blackman at once set to work on elaborating a scheme.

The problem to be faced was that, in addition to an area of 39,000 superficial feet for stock-rooms and secondary buildings which had to be lighted at a lower luminosity, a floor area of 51,000 superficial feet, containing a multitude of machines for envelope folding, gumming, printing, ruling, cutting, punching, embossing, type composing, and many other purposes, besides dozens of tables for sorting, labelling, &c., had to be efficiently lighted, and shadows on the work itself had to be avoided as much as possible.

The lamps used consisted of 142 100-candle power, 299 150-candle power, 28 300-candle power, and 10 500-candle power; the latter being used for lighting the outside of the factory. The tested consumption showed 1300 cubic feet of gas used per hour, and a consequent cost, at 2s. per 1000 cubic feet, of 2s. 7d. per hour for the entire installation—that is 0·43d. per 1000 candles per hour.

The lamps were so placed as to give the best light on the work. The lighting effect is fairly well shown in figs. 1 and 2; but really no photograph can do justice to the very gratifying result, which must be seen to be properly appreciated. Indeed, the excellent lighting makes a very striking impression on every visitor; but still more is he surprised when told the low cost per hour for this brilliant lighting. He then readily appreciates that the cost is repaid over and over again by the more efficient work which can be produced with good lighting, as compared with that which is produced with an inferior one.

The lighting effect in foot-candles of surface illumination was tested by the lumeter, and gave the following results.

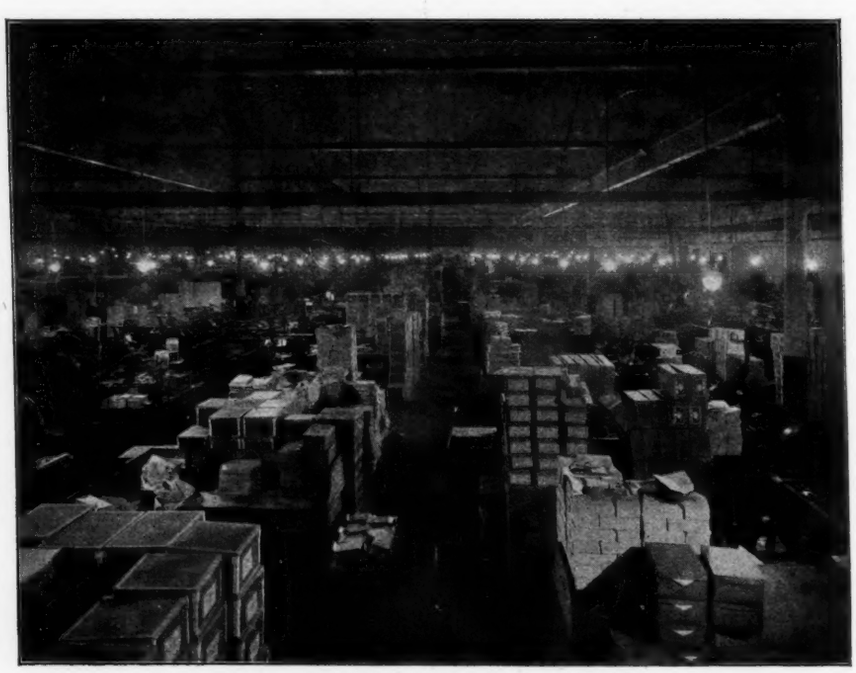


Fig. 2.—MILLINGTON AND SONS' FACTORY.

Fig. 3.—MILLINGTON AND SONS' FACTORY LIGHTED BY ELECTRICITY.

(1) Machine tables, 5·0 foot-candles.
" " 3·5 "
This gives an average reading of about 4·5 foot-candles over the whole of the machine tables.

(2) On the machines, 4·7, 3·6, and 5·2 foot-candles.
This will give a mean reading of 4·5 foot-candles on all the machines.

(3) Envelope folder and gumming:—

Bench	4·5 foot-candles
Shadow—*i.e.*, position where envelopes are counted	1 foot-candle
Ruling machines	8·1 foot-candles
Feed side of ruling machine	6·8 " "
Folding bench	3·8 " "
Litho machine	3·2 " "
Wharfedales	6·8 " "

(4) Compositors' frames:

The general reading taken in the centre of the lower frames was 8 foot-candles.

Approximately, the height of each lamp from the working plane to the mantle would be 4 feet; but, of course, it would vary as the height of the working surface varied.

I will now direct your attention to figs. 3 and 4, which represent the portion of the factory lighted by electricity. The lighting is done by means of tungsten lamps of the following candle powers:

351 32-candle power.
10 50 " "
10 100 " "
or a total candle power of 12,732.

This represents a total wattage of 15,940. At the low price of 1¼d. per unit, the cost is 1s. 7·9d. per hour, and the cost per 1000 candles per hour is 1·56d.

Tests were also made with the lumeter on the surface illumination given by the electric lighting, as follows:

Label department, Bench 1	1·8	Stationery packing	1·37
" " Bench 2	1·75	" "	2·0
Punching machine	1·38	Stationery	1·94
Packing	1·3	Embossing presses	3·0
Note paper machine	1·38	" "	3·4
Ruling machine, feeding	1 8	" "	4·1
Ruling machine, roller	1·34	" "	1·6
Cutting machine	1·6	" "	·43
Label making	1·54	" "	1·35
Loose cases	1·45	" "	2·1
Hand folding	64		

Fig. 4.—MILLINGTON AND SONS' FACTORY LIGHTED BY ELECTRICITY.

Fig. 5.—UNITED FLEXIBLE METALLIC TUBING COMPANY'S WORKS AT PONDERS END.

These figures give an average reading of 2·28 foot-candles over the embossing machines.

Gumming	1·3
,,	2·0
,,	1·32
,,	·79
,,	1·2
,,	2·9
,,	1 88

These figures give an average reading of 1·62 foot-candles over the gumming benches.

There was one bench in the stationery department at which a girl was handling fancy stationery, and the illumination was 0·39 foot-candles. There was no direct illumination source within a few feet, and the worker had her back to this lamp.

The following table will show concisely the area, the total candle power, the total cost of lighting per hour, the candles per superficial foot of floor area, the cost per thousand candles, and the cost of lighting per 1000 superficial feet of floor area in the different sections of the works.

—	Area. Super. Feet.	Total Candle Power.	Total Cost per Hour.	Candles per Super. Foot Floor Area.	Cost per 1000 Candles per Hour.	Cost per 1000 Super. Ft. of Floor Area.
			s. d.		d.	d.
Gas lighting—						
Factory	49,220	51,250	1 10	1·04	·43	·45
Stores, &c.	43,425	16,200	0 7	·37	..	·16
Outside	..	5,000	0 2	..	..	..
	..	72,450	2 7	..	·43	..
Electric lighting—						
Factory	58,425	12,732	1 7·9	·22	1·56	·34

I have assumed the rate for electricity at 1¼d. per unit, as that would be about the generating cost.

Here, it will be noticed particularly that for the factory, although the total candle power per foot of floor area is 4½ times as much in the case of gas lighting as in the case of electric lighting, the cost of the gas lighting is one-third more than the cost of electric lighting for a given floor-space.

Fig. 6.—UNITED FLEXIBLE METALLIC TUBING COMPANY'S WORKS AT PONDERS END.

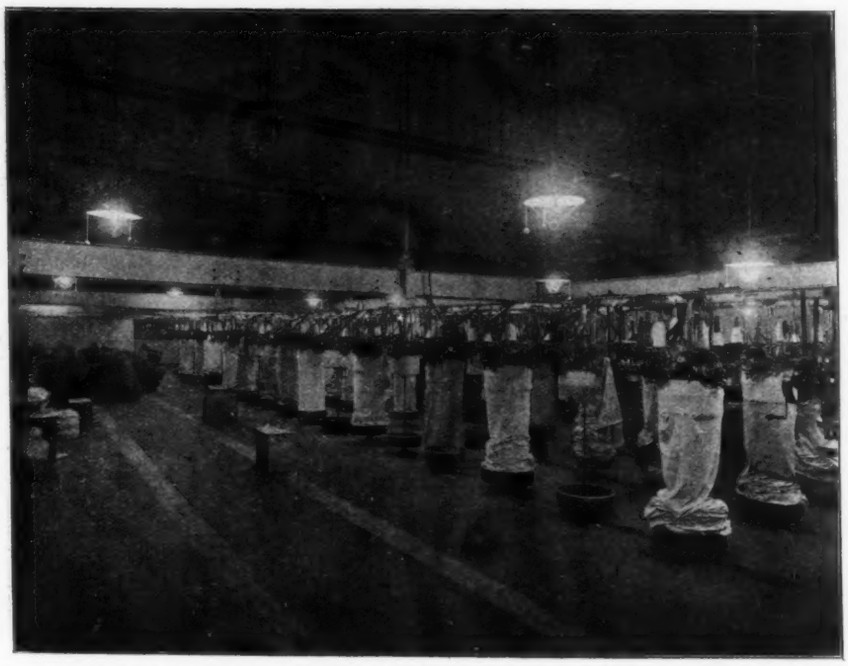


Fig. 7.—WOOLLEN UNDERCLOTHING FACTORY OF MESSRS. L. & H. SUSSMANN, LIMITED.

For the purpose of illustrating this more conspicuously on the screen, I have had slides prepared showing the electric lighted section and the gas lighted section both on the screen together. These slides show a combination of figs. 1 and 4 and figs. 2 and 3 respectively. It will be seen how the slight extra cost in gas lighting per 1000 feet of floor area is justified, and it will enable us to appreciate the comparative figure which the table shows as the cost of 1000 candles of high-pressure gas lighting, as against 1000 candles of electric lighting—viz., 0·43d. for high-pressure gas, and 1·56d. for electricity, using metal filament lamps.

The result of this demonstration to Messrs. Millington has been that we are to be entrusted with the work of lighting the large new extension to their factory; and we are hopeful that before long we may be able to displace electricity in the portion of the factory where it is at present in use.

On the Tottenham district we have many other high-pressure installations in factories, most of them doing important Government work at the present time, and, consequently, working night as well as day.

Figs. 5 and 6 show examples of the lighting at the works of the United Flexible Metallic Tubing Company at Ponders End. The nature of their industry is so well known to gas engineers that I need not describe it. The surface illumination as shown by the lumeter on the lathes gives the following readings:—

Lathes: 1·7, 1·48, 1·9, 2·0, 4·0, 5·6, 3·2, 1·5, 1·35, ·6, 2·1, 3·2, 5·2, 5·7.

The readings 4·0, 5·6, 5·2, and 5·7 were taken in close proximity to what appeared to be the lamp giving the best illumination.

Winding	1·63, 2·0 foot-candles
Rolling machine . .	1·0, 1·6, ·69, ·67, ·65, 1·5, 1·35

Figs. 7 and 8 represent the lighting at the Woollen Underclothing Factory of Messrs. Sussmann, Limited, where the lighting is partly "general" and partly "point" lighting. The total floor area is 5978 superficial feet, the total candle power 11,115. Readings for surface illumination are given in the table:—

Sewing department machines	11·5
Between machines	10·5
Ironing table (directly under 300 c.p. fitting) . . .	15·0
" " " " " " . . .	12·5
Half-way between above fittings (distance about 6 feet)	5·5
On ironing table between 300 c.p. lamps (about 8 ft. 6 in. high)	5·0
Weaving benches	10·5

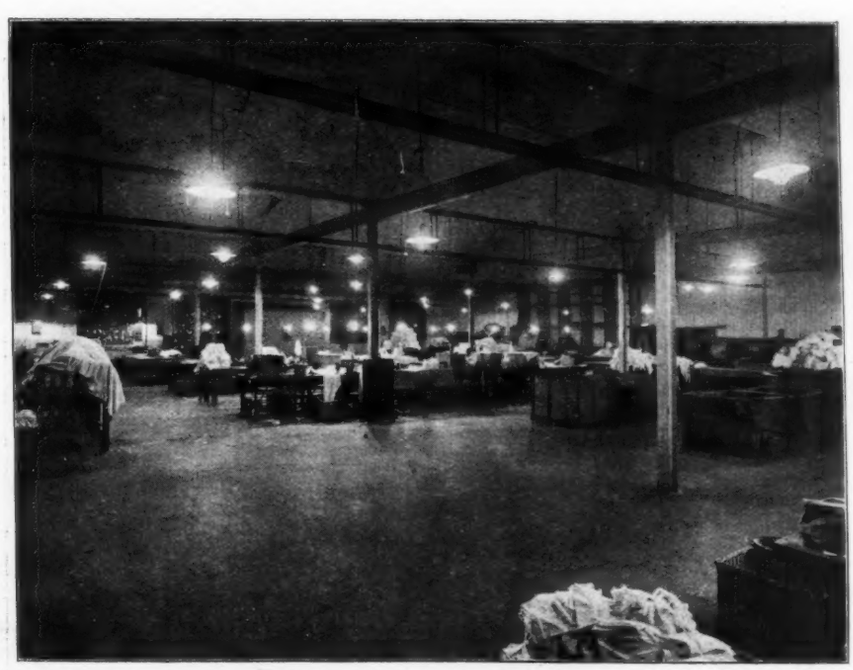


Fig. 8.—WOOLLEN UNDERCLOTHING FACTORY OF MESSRS. L. & H. SUSSMANN, LIMITED.

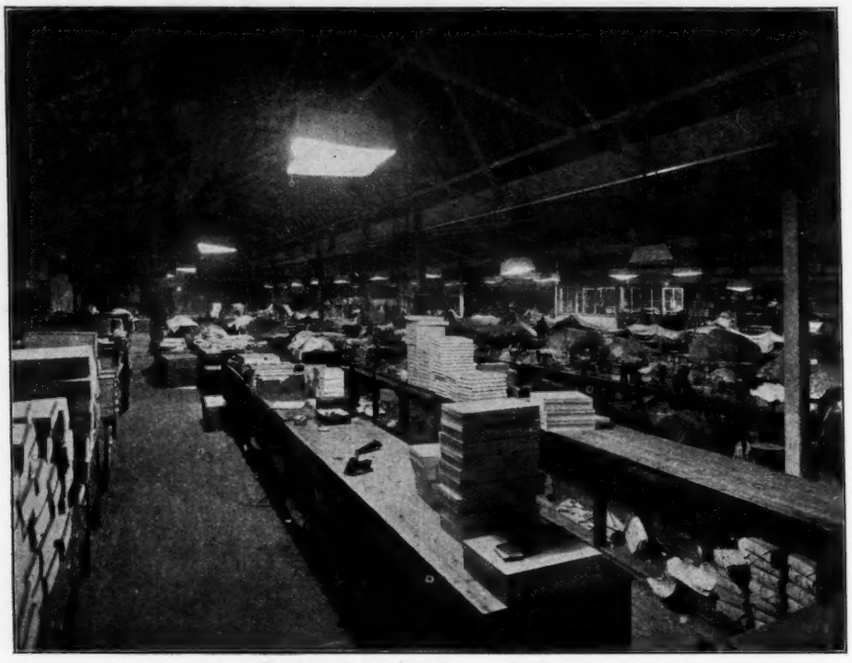


Fig. 9.—MESSRS. PENTONY & CO.'S FACTORY.

Directly underneath fitting (150 c.p.)	16·5
,, ,, ,, ,,	11·5
,, ,, ,, ,,	16 0
,, ,, ,, ,,	17·0
Between two fittings	13·5
Sewing machines—	
Needle	7 7
Between two machines	12·5
Random readings taken at second machine table	10·0
,, ,, ,, ,, ,,	11·5
,, ,, ,, ,, ,,	12 5
,, ,, ,, ,, ,,	13·2
,, ,, ,, ,, ,,	14·5
,, ,, ,, ,, ,,	13·0
Cutting bench (directly under 300 c.p. fitting (about 5 feet from working plane)	7·3
At an angle of about 45°	5·5
Second cutting bench, directly underneath	5·2
At an angle of about 45°	5·5
Weaving room and looms—on floor	4·5

This reading was taken between two lamps at approximately 6 ft. 6 in. from the ground level.

On working parts of looms	8·0
,, ,, ,,	7·5
,, ,, ,,	8·0
,, ,, ,,	7·8
On floor—gangway between rooms	5·5

It will be interesting for members to know that high-pressure gas-irons are used in this factory for pressing the work before packing, and they perform their work to the entire satisfaction of the management.

Fig. 9 shows the lighting of the factory of Messrs. Pentony and Co., where the aggregate floor area is 13,000 square feet, and the total candle power is 19,100. The work carried on in this factory is, among other things, ladies' blouses, ladies' leather belts, gentlemen's ties, portable pails, haversacks, &c. The readings for surface illumination give the following results:—

Eyeletting table (under 150 c.p. decorative fitting)	3·5
,, ,, (under 1000 c.p. suspension lamp)	10 5
Table by eyeletting machine	4·5
Sewing machine	9
,, ,,	4·5
,, ,,	8
,, ,,	7·5
Needle	4 5
Cutting bench	6·5
,, ,,	10·25
Ironing table	1·8
,, ,,	3·1
,, ,,	2·3
Needle	1·5
,,	·8
Cutting bench (150 c.p. deep shade)	6·5
,, ,, (150 c.p. flat shade)	4·75
Goffering machine (500 c.p. fitting)	7·5
By goffering bench	4

Fig. 10.—MESSRS. HOBSON AND SONS' ARMY CLOTHING FACTORY.

One peculiar feature of these figures is the shading of the lamps with cardboard shadings, on account of the fact that the daylight lighting of the factory is effected by means of the saw-tooth principle of roof. This large surface of glass necessitates the shading of the lights to satisfy present police regulations. Gas-irons are also largely used in this factory.

Among other factories with high-pressure gas lighting doing important Government work, in our district, are J. A. Prestwich and Co., J. Jacobs and Co., and Weber Bros. and Phillips; but time is too short to give particulars of these installations.

By the favour of Mr. A. Stokes, of the South Metropolitan Gas Company, I am able to give particulars of some important work that was carried out at the Army Clothing Factory of Messrs. Hobson and Sons, Tooley Street. Fig. 10 shows a very interesting view of one portion of the room where high-pressure gas lighting has been installed on one side of the room, but the other side is still dimly lighted by electricity. On the gas lighting side there are 28 150-candle power high-pressure gas-lamps using a total of 70 cubic feet per hour, giving 4200 candle power at a cost of 2d. per hour, taking the price of gas at 2s. 4d. per 1000 cubic feet.

The following readings were taken by the lumeter:

Gas Side.

Under lamp	13·0 foot candles.
Between lamps	8·5 ,, ,,
On work, on knee	6·1 ,, ,,
,, between lamps	5·9 ,, ,,
Height from bench	4 ft. 0 in.
Spacing	4 ,, 6 ,,

On the electric side the illumination is provided by means of 24 105-volt. 30-watt Osram lamps, and 4 16-candle power carbon lamps—a total candle power of 784 candles. The lumeter gave the following readings:—

Electric Side.

Under lamp	6·7 foot candles.
Between lamps	2·2 ,, ,,
Needle plate	3·9 ,, ,,
Height from bench	1 ft. 9 in.
Spacing	3 ,, 3 ,,
Distance from needle plate	2 ,, 3 ,,

I am not aware of the price paid for electricity in this factory; but, assuming it to be 3d. per unit, the cost per hour would be 2·92d., and the comparative value with the two pennyworth of gas on the other side of the room is very striking indeed.

It has been suggested to the photographer that his expertness in his business (and he is one of the most expert photographers in this line) would enable him to produce deceiving effects; but, although he admits that it may be possible to make deceptive photographs, he indignantly repudiates the suggestion in his case, and states that he values his reputation far above any consideration of rival business interests in artificial lighting or any other industry. He admits, however, that in this photograph the articles on the electric side would have been almost invisible if he had not placed a lot of white articles on the machines and tables, so as to produce some outstanding features, while the articles on the gas side were mostly khaki cloth.

The firm and its managers are so well pleased with the result of the introduction of high-pressure gas lighting in place of electric lighting that they feel amply rewarded for the trouble and inconvenience to which they were put in making the change during a time of exceedingly high pressure, when they were carrying out very urgent work for the Government. They are satisfied that the inconvenience to which they were put was very rapidly made up to them by the acceleration of work which resulted from the improved lighting.

I trust this somewhat scrappy information will be interesting and useful to members when they have occasion to modernize the lighting in any existing factory or design it for new ones. Before concluding, I desire to express my thanks for the great assistance I have received in the preparation of these particulars from Mr. A. J. Whyte, of Messrs. Keith and Blackman, Limited.

DISCUSSION.

The PRESIDENT (Mr. W. B. Farquhar) said the members had had a highly interesting paper from Mr. Broadberry. It proved what could be done with high-pressure gas lighting against electric lighting. The author was favoured with a district where a large number of factories were being erected; and so he had special opportunities of doing work in this direction. While high-pressure gas lighting was a success on the large scale, it was also possible to use it on the small scale; and any gas undertaking could give as much satisfaction to one factory, as it could to half-a-dozen.

Mr. J. S. DOW (London) said that Mr. Leon Gaster, who had been present earlier in the proceedings by invitation of the Committee, had unfortunately had to leave before Mr. Broadberry's paper was read; and he (Mr. Dow) wished to say a word or two on his behalf. Mr. Gaster had been very interested in reading Mr. Broadberry's paper; and he was sure he would be sorry that he had not had an opportunity of seeing the excellent series of photographs that Mr. Broadberry had shown on the screen. Mr. Gaster was a member of the Departmental Committee which was now sitting to consider factory lighting; and, in view of this Committee having been appointed, papers of the kind the members had just heard were of great interest. At the present time, one could not say much about what the Departmental Committee were doing; but they hoped, when eventually the result of their labours was published, it would have some useful effect in stimulating public interest in appreciating the value of good factory lighting. In the future, there should be a great advance in this respect. As Mr. Broadberry had rightly pointed out, it was a very complex matter to make comparisons of this kind. They had to take into account, in addition to cost, the questions of flexibility, adjustability, and so on, as well as efficiency. There was one point he should like to congratulate Mr. Broadberry upon—that was, the series of foot-candle figures he had given in each case. For factories of the kind mentioned, it was very useful to have a series of figures like this; and it had often struck him in comparisons of cost whether really too much was not made of the candle-power of the lamps themselves, without emphasizing the individual actual value that they got on the working plane. The figures Mr. Broadberry had obtained were certainly high; and the photographs also gave the impression that the illumination was quite adequate. The whole question of the application of high-pressure gas to factory lighting was one of great interest.

Mr. W. TOWNSEND (Colchester) congratulated Mr. Broadberry on the splendid paper he had given the members. To those who were trying to push high-pressure gas, it was of great interest, and would be of considerable value. The paper was of particular interest at the present time, because some of them had been rather apt to form the idea that there was nothing to be done in the lighting business at the present time. The author had given them a lot of practical information; but there were a few questions he (Mr. Townsend) would like to ask. The first one was as to whether any trouble had been experienced from glare with these tremendously powerful lights. There was a great deal of difference in some of the illustrations. In certain of the later ones, the lights were well shaded, and probably the operators would not suffer any inconvenience from having the lights in proximity to their work. In the earlier illustrations, it seemed to him that the light from the lamps might be thrown into the eyes of the operators, and cause discomfort. He should also like to know whether Mr. Broadberry really measured the illuminating power of the lamps to arrive at the total candle power, or whether he took the nominal figures. Another point of great importance was the type of fittings used. Sometimes preference was given to the electric light because of the flexibility where lights had to be moved a few feet from one place to another. Had movable fittings been used in any of these high-pressure cases? Another question that interested him was as to lamps over cranes in engineering works. They had at Colchester to give a quotation some little while ago for a case in which the lamps had to be high enough in the roof to let a crane pass, with arrangements for subsequent lowering in order to get sufficient illumination at the working level. It was a question of obtaining reliable means for raising and lowering high-pressure lamps. In confirmation of what Mr. Broadberry had said about the production of munitions, in his own experience this was bringing engineering works and other factories to the fore in the matter of lighting. He had that day received from Messrs. Davy, Paxman, and Co. an inquiry respecting high-pressure lighting for one section of their factory; and he was hoping that, through this, his Company might get the lighting of the whole factory. They were also lighting Messrs. Spottiswoode's printing-works. High-pressure lamps were giving satisfaction wherever they had installed them.

Mr. BROADBERRY, in reply, said he thought the questions could be satisfactorily answered. Regarding glare, Mr. Townsend suggested that some of the lights appeared to him to be very powerful ones. But he would find on reference to the paper that they consisted chiefly of 100 and 150 candle power units. In the factory, there were 142 100-candle-power lamps, 249 150-candle power ones, and 28 300-candle power ones; and outside there were ten 500-candle power lamps. The glare from the last-named lamps, their situation being outside, would not affect any one's eyes. The 100 and 150 candle power lamps were placed in such a position that there was no disadvantage whatever from glare—in fact, he was speaking to Mr. Godfrey, the Managing-Director of the firm, only the previous day, and he said how greatly pleased they were with them. He was also told that the workpeople themselves had expressed their satisfaction with the improved lighting ever since it was installed. Mr. Townsend also wanted to know whether they photometrically tested each lamp, or simply assumed the nominal candle power to be correct. Lamps were from time to time photometrically tested; but in an installation of this sort, they did not have photometrical tests of every individual lamp. With regard to movable gas-fittings, they had not been installed. But there were movable fittings to be had; and he should be very pleased to send Mr. Townsend or anyone else the name of the makers of them. There was, for instance, one made for lathe work which could not only be raised and lowered, but could be swung round in a circle, and the radius of the circle could be extended or shortened at will. It was a useful fitting for lathe work, or for composing tables, and other purposes; and where they had applied it, it had given great satisfaction. One other question was in regard to raising and lowering lamps, so that a crane could pass. For this purpose, there were some suitable fittings made by a firm in South London; and he would also in this case be pleased to supply the address of the makers to anyone who wished to have it. In connection with the subject of glare with high surface illumination which seemed to exist on some of the machines, when an actual measurement was taken with the "lumeter" on a bright summer day, it was astonishing how low in comparison the surface illumination was with the lamps. The "lumeter"

was made so that one could read down to the second place of decimals in foot-candle illumination, or up as high as 2000 foot-candles in bright sunlight. With all the bright lights they were now producing by high-pressure gas, they were not too bright for ordinary lighting; they could not hurt the eyesight so long as one came within their range gradually. Passing out of the dark into a bright light did have some effect on the eyes; even passing from the dark into the sunlight, one felt some effect on the eyes. But to work in the light of any of the lamps he had shown was not detrimental to the eyesight.

COST OF GAS AND COAL FIRES.

Practical Tests at Manchester.

Intimation is made in the news columns to-day of the fact that the Town Hall Committee of the Manchester Corporation have decided to recommend the Council to substitute gas-stoves for many of the coal-fires now in use in the Town Hall. As long ago as March, 1913, the Council adopted a resolutiou that, as one step towards smoke abatement, the Town Hall Committee be instructed to consider and report to the Council upon the advisability of replacing coal-fires with gas-stoves or electric radiators wherever possible, in all rooms and offices under their jurisdiction. After conference with the Chairman of the Gas Committee, it was decided that gas-stoves of approved pattern should be fixed in Committee-rooms Nos. 1 and 4: but a similar conference with the Chairman of the Electricity Committee led to a decision not to fix and test electric radiators.

Two makes of gas-stoves (with a separate meter attached to each) were fixed; and after the first period of the tests, the stoves were interchanged and again tested. Records were taken showing: (*a*) The number of hours per day the gas-fires were in use; (*b*) the amount of gas consumed per hour; (*c*) the temperature of the rooms. In No. 2 Committee-room, where the temperature was raised by means of a coal-fire, records were taken of: (*a*) The number of hours per day the fire was lighted; (*b*) the temperature of the rooms; (*c*) the cost of coal.

The report to the Committee on the experiments, which is signed by Mr. H. Derwent Simpson (the Chairman), says the tests show that, though coal-fires are cheaper in comparison to the gas-stoves in cases where rooms are used continuously, and where burning goes on continuously throughout the day, gas-stoves are more economical, and produce a more rapid rise in the temperature, in cases where rooms are used intermittently. On these grounds, the use of gas-stoves is desirable in Committee-rooms which are used only occasionally or intermittently during a day. There is also in their favour greater cleanliness, and a saving in labour attendant on their use.

Cost per Degree Rise.

The following analysis shows the average cost per degree in rise of temperature during the whole period that the tests were made:—

Fire.	Committee Room No.	Intermittently in Use.	Total Increase in Temperature for Whole Period of Test.	Total Cost of Gas.	Cost per Degree Rise of Temperature.
		Hours. Minutes.	Degs.	s. d.	d.
Make A . .	1	51 14	45½	4 4	1·143
,, B . .	1	31 35	36½	2 2	0·712
,, B . .	4	25 10	68	1 4	0·235
,, A . .	4	19 55	39	2 2½	0·679

The results of the tests of the coal-fire in No. 2 Committee-room must be considered in connection with the fact that the fire was burning on seven days when the room was not used. Records on these seven days were not taken. It is therefore not possible to give the exact cost per degree of the rise in temperature in the case of the coal-fire; but having regard to the records actually taken, a fairly close estimate of the temperature rise on the seven days may be made—namely, 4° per day. The 3s. 5d. cost of coal includes the coal consumed on the seven days. The effect of the records actually taken and the estimate for the seven days is that the cost per degree in rise of temperature in the case of the coal-fire may be taken to be—

Total Increase in Temperature for the Whole Period of Test.		Cost of Coal.		Cost per Degree in Rise of Temperature.
92°	..	3s. 5d.	..	0·445d.

The coal-fire was burning (say) 7¾ hours a day for 24 days, which gives a total of 186 hours.

In conclusion, the Chairman said he considered it advisable that gas-stoves should be fixed in the various Committee-rooms, the members' room, and any other rooms in the Town Hall used intermittently.

Acknowledgment is made of the services rendered by Councillor Harold Wood in connection with the carrying out of the tests; and the following report on the subject by him is given as an appendix.

Councillor Harold Wood's Report on Tests of the Comparative Merits of Gas and Coal as Heating Mediums.

During the period of the several tests, important points in favour of gaseous fuel for heating have been emphasized, and may be briefly summarized as follows:—

1.—Economy.
2.—Therefore low cost of heating.
3.—Rapidity in fire becoming incandescent and giving its maximum efficiency.
4.—Rapid rise in temperature of room.
5.—Regular and constant temperature, under perfect control.
6.—Absence of dirt and dust, carrying coal, removing ashes, &c.
7.—Saving in labour.
8.—Intermittent heating [the advantages of gas are so obvious that it is unnecessary to enlarge on this point.]

These tests, as the following comparative figures show, prove conclusively the superiority of gaseous fuel over coal for heating offices, committee-rooms, &c.

The rooms in which the tests were carried out are required only a few hours intermittently; and it is desirable, therefore, that the heating medium be capable of sufficiently increasing the temperature in the shortest possible time. It is a generally accepted fact, and as the tests prove, that a coal-fire has to be lit about an hour-and-a-half before the temperature of the room is appreciably raised, whereas a gas-fire starts its work at once.

The rapidity with which a room is heated by gas as compared with coal is shown by the following figures:—

—	Committee Room No.	Date of Test.	Increase in Temperature.	Time Fire Alight.	Total Cost. d.
Gas-fire	4	Feb. 19	3°	40 mins.	0·33
Coal-fire. . . .	2	,, 23	2°	6 hours	1·3

The cost per degree in rise of temperature was therefore—

Gas . . . . . 0·11d.
Coal . . . . . 0·65d.

It will thus be seen that, in these particular tests, in addition to gas raising the atmosphere in the room to the desired temperature in a much quicker time than was the case with the coal-fire, the cost of each degree increase in temperature was very much heavier with coal than gas. In fact, it will be noticed that, even at the end of the six hours' test with coal, the increase in temperature with that fuel was only 2°, as against 3° with gas in one-ninth of the time. The shortest time a coal-fire was under test was six hours. [This is the test referred to above.]

If we turn to the total consumption of gas and coal for the whole of the period during which the tests were made, it will still be seen that gas more than holds its own on the score of economy alone, quite apart from its undisputed advantages in quick rise of temperature of room, saving of labour, absence of dirt, carrying of coal, &c.

It will be seen from the following analysis that the average cost during the whole of the period during which the tests were made as aforesaid, of raising the temperature of the room 1°, was—

Gas . . . . . 0·23d.
Coal . . . . . 0·44d.

Or a saving in favour of gas of 0·21d. on every degree increase in temperature.

—	Committee Room No.	Total Increase in Temperature During a Period of Fifteen Tests.	Total Cost of Gas.	Cost per Degree Rise of Temperature.
				d.
Gas-fire	4	68°	1/4	0·23
Coal-fire . . .	2	During 24 Tests, 92°	Cost of Coal, 3/5	0·44

One great advantage of the gas-fire for heating the rooms under consideration is that it can be got to work at a moment's notice, with the certainty that the rooms will be quickly raised to the desired temperature. No smoke, soot, or dust is emitted from a gas-fire, as in the case of a coal-fire. This is a consideration in offices, &c., where papers, documents, &c., have necessarily to lie exposed on desk or table.

Men of science, including the medical faculty, recognizing the utility, economy, and hygienic qualities of the modern gas-fire, are not only recommending these mediums to their friends, but are using them in largely increasing numbers in their homes and consulting-rooms. One specialist in Manchester alone has sixteen gas-fires fitted and in use at his residence and professional rooms.

One more fact must be emphasized—that the foregoing tests with gas-fires and coal-fires were in every sense of the terms practical, every-day working results, independent of interested parties.

The readings were recorded by one of the Town Hall staff who was (and is) not concerned with the merits or demerits of the two forms of heating.

These comparative tests obtained by such unbiassed means again prove the great superiority and economy of gas over coal for heating the Committee-rooms in the Manchester Town Hall.

Mr. Vernon Harcourt on the Efficiency of Domestic Fires.—In accordance with announcements which have appeared in the "JOURNAL," Mr. A. G. Vernon Harcourt, F.R.S., who is one of the Metropolitan Gas Referees, will read a paper at the Royal Society of Arts to-morrow evening "On the Measurement of the Efficiency of Domestic Fires, and on a Simple and Smokeless Grate." Mr. F. W. Goodenough, the Controller of Sales of the Gas Light and Coke Company, will preside.

SOME "HORIZONS" OF THE GAS INDUSTRY.

By J. G. Clark.

[A Paper read before the London and Southern District Junior Gas Association, April 30.]

Many of you no doubt have experienced the pleasures of mountaineering, away from the hustle and bustle of industry and commerce, and will remember the irrepressible desire that is forced on one to moralize on the various sensations experienced. For instance, having mapped out a plan of campaign for a day's outing, one starts upon an ascent to a towering horizon; and after plodding and scrambling along for a few hours, one reaches the horizon, only to find another one not previously visible spreading out further on. This experience may repeat itself several times; each new horizon being reached after traversing a more or less difficult path strewn with obstacles of various kinds that impede one's progress—as, for instance, the slippery scree which, resting at its angle of repose, is ready at the slightest touch to send the unwary traveller down a hundred feet or so, so that he has again to retrace his steps, armed, however, with newly-gained experience; or, again, the lurking bogs which lie hidden by moss, but ready to receive into their murky folds him who aspires to the distant horizon. And before the cairn which marks the topmost summit is reached, one might have to step or wade across a heavy torrent, penetrate through a dense mist, clamber gingerly across a treacherous glacier, or step with careful poise over an ugly heap of sharp rocks into the crevasses of which one's alpenstock might slip, causing a few bruises and a scratch or two which only seem to stiffen one's determination to push on until the goal that was set out for is reached. All these experiences are given special point to by the presence of companions to whom we can give, and from whom we can receive, a helping hand; and on reaching the summit one can rest, and enjoy the satisfaction that can only arise from positive achievements against difficulties. If this experience is contrasted with what it would be if we were "pitchforked" to the summit without all the "trouble and fatigue" of the upward journey, a valuable lesson of life and living will be learned.

When considering what I should write about on this occasion, I followed the above line of thought in its relation to the great industry and public service with which we are all associated; and it appeared to me a not uninteresting topic to reflect upon a few of the "horizons" of the gas industry—some that have already been reached, some that appear to be within reach, and some that can at present be only dimly seen in the distance—and to try and perceive the direction in which future development lies. In this way we shall, I hope, find some opportunities of relating our experiences and small efforts towards improvement. Primarily and mainly, the business of the gas industry consists in the manufacture and supply of "inflammability" in gaseous, liquid, or solid form; and it is in regard to these that I shall ask your attention.

Lighting.

If the history of gas lighting be studied, it will be found that there are a number of distinct and successive "horizons," each seeming to represent a definite epoch, and leaving a temporary impression that finality had been reached—an impression that subsequently disappeared with further developments. There is, of course, no reason to regard the present position as final. Far from it. In fact, when it is remembered that even our most efficient sources of light develop, as visible radiation, only a few per cent. of the energy of the gas, our present methods must in the ultimate sense be regarded as wasteful in an extreme. It can safely be said we are far from the cairn that crowns the summit of lighting efficiency. The course of future developments seems to lie in the direction of: 1. The better utilization of our present methods of producing light. 2. The production of still more efficient sources.

I put the utilization aspect first, because the means for development in this direction are already in our hands. But they so often seem neglected that one may be pardoned for raising the question. It is the aspect, too, that more directly concerns the salesman, and cannot, I think, be regarded too seriously. For instance, there are a number of very shoddy gas-lighting appliances foisted on the public nowadays, which develop in many cases little more than one-half of the illuminating efficiency obtainable from a good burner. The substitution of an approved burner for one of the shoddy type, therefore, means that the cost of lighting in the particular case is reduced by one-half, which is equivalent in economic value to that particular consumer to halving the price of gas. Looked at from this standpoint, the salesman's expert advice has an important bearing upon the price of light, which is, after all, the commodity we sell through the incandescent burner.

In glancing through some observations I made a little while ago, I find the following data which indicate very clearly the significance of this matter. Some cheap burners were purchased over the counter at various incandescent stores (usually allied to a cycle stores or a barber's shop); and on examination they gave the following results.

In the case of "C" burners, the consumption at 25-10ths pressure was found to be anything between 3·15 and 5·35 cubic feet per hour. When we remember the care taken by reputable firms in designing their lighting appliances, it is, to say the least, disappointing that such rubbish is to be found on the market Alas, some of them bore the mark "Made in England." The weight of the cheap burners was less than one-half that of a good pattern—indicating, therefore, but a small expectation of life. Curiously the initial photometric efficiency was fairly good, varying from 15·0 to 20·5 candles per cubic foot of gas; the average being 18·5.

As in the case of upright burners, so in the case of inverted—"only more so." The consumption at 25-10ths varied from 2·33 to 4·25 cubic feet per hour; and the photometric efficiency from 9·8 to 15·2 candles per cubic foot; the average being only 13·8 candles. The material was less than one-half of the weight of a good ordinary burner.

There is a rapidly growing tendency on the part of the public to consult the gas companies regarding their gas appliances. This is all to the good, and benefits the consumers and gas companies alike—the former getting better value for their money, and the latter a permanently satisfied consumer.

So much for the quality of the units. No less important is the choice of a suitable type of unit, and its proper arrangements for particular purposes. It will usually pay to consider carefully the particular requirements of every case, and then select from the great variety of units now available one which will best serve the purpose. If it were the object of this paper, I could refer to a number of actual experiences to prove the economic value of this; the distribution of the illumination having been improved by some simple alteration in the disposition of the units. It is usually a common-sense matter, like fitting round pegs into round holes and square pegs into square holes.

I am strongly constrained to regard the choice of efficient and suitable units and their correct disposition as a "horizon" that can, and should, be immediately approached; and with the knowledge now at our disposal, it will be attained almost as soon as it is approached.

More Efficient Sources.

As already mentioned, our most efficient sources of light convert only a few per cent. of the potential energy of the gas into luminous radiation. In looking back over the history of this subject, one is struck by the astonishing progress that has been made. I have plotted a series of polar curves [p. 280] to illustrate this; and when it is remembered that the remarkable progress that is indicated is but a trifle of the potential power of gas, we realize how much still remains to be done.

Three main lines of development seem to be open to us—namely: (1) The production of higher temperatures, (2) the use of more efficient radiating materials, and (3) more efficient methods of presenting the heat to the radiating material. There can be no question about the advantage of high temperatures. Using oxygen with the primary air supplied to an incandescent burner, I have obtained over 100 candles per cubic foot, and it is very probable that if the burner had been modified to meet the special conditions, still better results would have been obtained. This, of course, only confirms the general opinion regarding high temperatures.

In regard to the transfer of the heat of combustion to the radiating material, personally I regard our present methods as crude. To heat up a mantle on the inside to get light from the outside seems far from finality. A great quantity of luminous radiation is emitted from the inside surface of the mantle, but only a fraction of it succeeds in getting out as useful light. Some day we might succeed in making a mantle without these defects. Again, the use of a flame for heating-up the mantle seems by no means to be the last word. We have heard of surface combustion as a method of presenting heat to the radiating material. It is more efficient than ordinary flame contact, apparently because the burning molecules come into more intimate contact with the radiating body. We may find means of doing something like this for lighting. It is always a good thing, when considering lines of new development, not to adhere too closely to established methods. History abounds with illustrations of this.

Colour of Light.

Another aspect of artificial lighting is the question of colour. It is notorious that none of the modern sources of light have the same colour qualities as daylight. In most cases there is a deficiency in the blue and a corresponding excess in the red, though in certain types of electric lamp (vapour lamps) the defect is in the reverse direction. It is well to remember that while the question of colour is of some importance in certain kinds of work, there seems no reason for regarding it as desirable—even if attainable—for general illumination. One would expect that man in the course of the ages, during which flares, torches, and fires have served as sources of artificial light, has become acclimatized to a daily rest from the daylight spectrum; and this consideration, together with the fact that the colour deficiency of most modern sources of light lies in the region of the spectrum having the lowest lighting value—the blue—makes it appear that there is no special reason why developments in the direction of producing "artificial daylight" for general use should be sought for.

However, the value of artificial daylight for certain branches of work cannot be gainsaid. It means money to many manufacturers and tradespeople whose business would otherwise either be hampered or entirely held up when daylight fails. I have encountered cases where the provision of a colour corrected gas-lamp has proved a great boon to the user. The problem has to

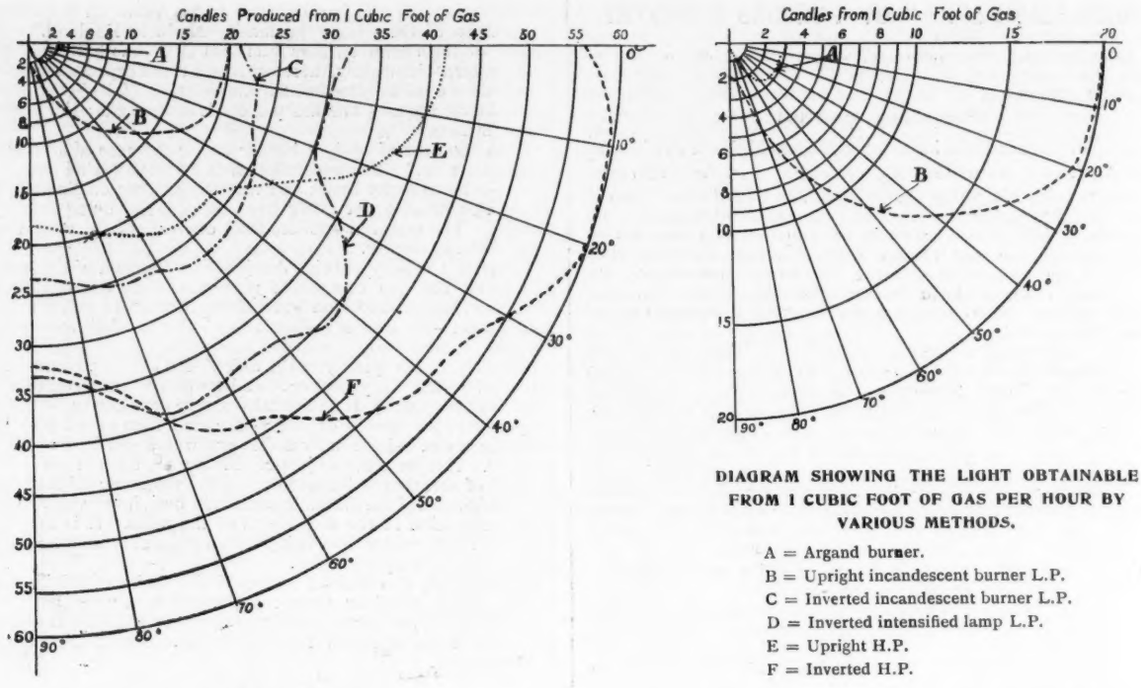


DIAGRAM SHOWING THE LIGHT OBTAINABLE FROM 1 CUBIC FOOT OF GAS PER HOUR BY VARIOUS METHODS.

A = Argand burner.
B = Upright incandescent burner L.P.
C = Inverted incandescent burner L.P.
D = Inverted intensified lamp L.P.
E = Upright H.P.
F = Inverted H.P.

some extent been solved on empirical lines; but much remains to be done. There are, of course, two ways of correcting the colour of the light—namely: (1) By subtracting the rays that are in excess. (2) By adding the rays that are deficient.

Even these methods only partially meet the requirements of practical work, because it must be remembered that though daylight is white light, white light is not necessarily daylight. This I can best illustrate by an experiment. The subtractive method is usually done by transmission through a filtering screen of specially prepared glass, and sometimes by reflection from coloured surfaces. The rays that are in excess are thereby filtered out, leaving the transmitted portion approximately colour true. I say "approximately true" because the transmitted light does not possess the daylight proportions throughout the whole of its spectrum.

I can plead guilty myself to having designed a lamp on the absorptive principle; and experience in a west-end establishment has indicated its practical usefulness for colour matching in the textile trades. I have a specimen here. It consists mainly in placing the absorptive screen between the source of light and the object illuminated, together with a tubular screen to diffuse the light and prevent the overheating of the absorptive screen. An interesting, and I think important, variation of this is to use the absorptive screen in front of the eye, instead of under the lamp. In this way the object is illuminated by uncorrected light, but is viewed through the absorptive screen, which may conveniently take the form of a pair of spectacles.

In experimenting on the question of colour matching some two years ago, I encountered two very serious difficulties: 1.—The difficulty of getting accurate screens of sufficient area. 2.—The risk of breakage and consequent expense.

It was found to be an easy matter to prescribe the nature of the glass from which the screen was to be made, but a very difficult thing to realize. Again it must not be overlooked that when the light is corrected, about one-half of its illuminating power disappears, owing to the absorption of the red and yellow rays—a very serious matter in connection with general illumination. It was when facing these difficulties that the use of small screens in the form of spectacles occured to me; and subsequently I was able to prove mathematically and experimentally that screens used in this way gave results identical with those obtained by screens used in the lamp itself.

The advantage of the "eye screens" or spectacles as compared with lamp screens appear to be as follows: (1) The whole illuminating value of the source of light is available for general purposes. (2) Ordinary lamps may be used. (3) The screens, being much smaller, can be made with greater accuracy. (4) The screens are obviously much cheaper and less liable to breakage.

I would like to state here that, subsequent to my own work regarding the use of spectacle screens, Dr. Ives, of New York, published an account of some research work which indicated that he had been engaged on a similar investigation, and had prescribed eye screens (spectacles) as an alternative to lamp screens. However, as already remarked, the use of absorptive screens of any kind cannot be regarded as final. We have still to produce a continuous spectrum identical with daylight, though for practical purposes the absorptive method serves very well for the time being. The ultimate solution seems to be in the choice of different radiating material worked at a higher temperature.

As a general rule, the radiation from a solid body tends to increase towards the blue end of the spectrum with an increase of temperature; so that we may, I think, look towards higher temperatures as one means of producing a colour-true light. As a step in this direction, I have tried oxy coal-gas flames for heating the radiating body, using thorium oxide instead of the usual mantle mixture; and the results confirm my opinion that this is a promising direction in which to work.

Water Heating by Gas.

In this application of gas, we seem to have arrived at something approaching perfection. Efficiencies of 90 per cent. based on the gross heat value are obtainable with the best modern circulating boilers; but it must be remembered that this figure does not include heat losses from the circulating and other connecting pipes in the installation, losses which are, of course, incidental to all methods of heating and all kinds of fuel. It is in this direction that considerable economies can often be effected.

We have in recent years seen some remarkable and popular developments in the direction of heat insulation by means of vacuum jackets. Is it too much to expect that some specially made thermally insulated pipes might be designed for gas or electrically heated water installations? I mention our competitors here, because the heat supplied by them is more expensive than that furnished by us, and therefore its conservation is all the more important.

The jacketing of the pipes of gas or electrically heated circulator installations is more important than where solid fuel is used. The latter may be termed "crude heat" and the former "refined heat"—100 heat units of "refined heat" being more valuable in applicability than the same quantity of "crude heat." It is true that jacketed pipes may prove to be expensive; but when it is remembered that about 12 cubic feet of gas per hour is necessary to make up for the heat losses from 100 feet run of exposed pipe, it will be realized that the saving in gas will soon make up for it. One must not overlook the fact that the loss of heat from the pipes and tank goes on for anything between 12 and 24 hours a day; and it is not inconceivable that a badly arranged system of piping might be responsible for heat losses exceeding in amount the heat actually used as hot water.

In some experiments I made a little while ago, I found that, by placing the pipes in an enclosed air-jacket, the heat loss was reduced to rather less than half of what it was with bare pipes. It seems to me, from the present position of water heating by gas, that effective and cheap insulation of the pipes is the direction where progress might very well be looked for.

Gas-Fires.

Here, again, remarkable progress has been made; and the gas industry should not fail to acknowledge the pioneer work done by gas-stove manufacturers in elevating the efficiency of their appliances to such a high standard. Looking back at the gas-fires supplied to the public a few years ago, one is struck by the scientific progress that has been made. I often tell people that the gas-fire is really only about seven years old; patterns prior to seven years ago being really obsolete.

I am not going to put my head into a hornets' nest by saying which of the gas-fire manufacturers initiated the forward movement. It is enough for us to know that it has been supported by the various gas-stove firms, all of whom have succeeded in making definite advances which, taken together, constitute the really fine appliances that are now at our disposal. Modern fires

develop radiation with an efficiency equal to nearly 60 per cent.; and even higher values have been reported on reliable authority. It seems, however, that before still higher efficiencies are striven after, the question of the intensity of the radiation could very profitably be studied.

If it was found possible with a good modern gas-fire to increase its radiant efficiency by (say) 10 per cent. without increasing the area of the radiating surface, the radiation would be so scorchingly intense as to be really uncomfortable, and this discomfort would be a serious set-off against the higher radiant efficiency. The effect would be somewhat akin to what we know as "glare" in artificial lighting. If, however, by using a new design of fuel, the area of the radiating surface could be increased, the radiation emitted would be more diffused, and therefore more comfortable. The secret seems to lie in the formation of the fuel, and very probably might be found in a design that was radically different from present forms.

I am constrained to suggest that gas-fire makers, and all who are interested in the further development of gas-fires, could very profitably turn their attention to this aspect of the question, in order to pave the way for still higher, but at the same time comfortable, radiant efficiencies.

Gas for Power.

The conversion of the calorific power of gas into mechanical energy has reached a very high state of perfection; something between one-third and one-half of the heat being actually utilized. But here, again, modern research into the phenomena of explosion and the behaviour of gases at high temperature indicates that finality has not been reached. Recently, at the Royal Institution, Mr. Dugald Clerk, D.Sc., made known some hitherto unpublished research, and indicated some remarkable effects produced by eddy and convection currents in explosive mixtures. These eddy and convection currents will, if properly directed, accelerate the velocity of flame propagation in the exploding mixture; and this is all to the good in the production of mechanical power. It is not at all unlikely, now these phenomena are understood, that we shall hear of their practical application to engine design, and a new and definite forward-step made.

It will be recalled that the effect of eddies in an explosive mixture arose during the discussion in a paper I read before you over a year ago.

Rating of Gas Appliances.

Considering the extent to which science has been applied during recent years to the perfection of gas appliances, it seems that the time has arrived when some recognized standard methods of evaluating them should be agreed upon. This applies more or less to every field of gas engineering. Differences in point of view often lead to very conflicting comparisons. It seems easy to avoid absurd statements; it is also easy to be led astray.

We have heard of water-heaters giving over 100 per cent. efficiency, of lamps giving extraordinary efficiencies in candles per cubic foot, and of gas-fires giving remarkable radiation values. All these misunderstandings seem to be due to fundamental errors, and lead in the end to absurdities. For instance, if a water-heater has an efficiency of 101 per cent., I see no reason why it should not ultimately become 1000 per cent.

A stage has, I think, been reached when the fundamentals of gaseous combustion should be accurately stated and agreed upon. We in the gas industry are working in the reverse order to our electrical competitors, who established their fundamentals before developing their industries. But there is no reason why the foundation of future scientific progress in applications of gas should not now be laid. I have noticed sometimes a tendency to despise scientific research work that has been done in connection with gaseous combustion; the only reason being apparently that the practical application of the results was not obvious. The authors of this kind of work probably succeed in unravelling some complication, which will set the finger-post towards new fields of development. The gas industry owes too much to work of this kind to allow it to be despised. Such apathy would have tended to kill the great work of Welsbach, and if persisted in would only hamper future progress. Now that we have intimate association with the higher centres of learning, we are witnessing the approach to what is probably a new "horizon," from which we shall have open to our view new fields to explore. The day when no such fields will be open to us will be a very unhappy one.

The reading of the paper was accompanied by a series of lantern slides, some exhibits, and several experiments bearing upon the colour constitution of light from the point of view of practical colour matching by incandescent gaslight. Mr. Clark was able to demonstrate to the satisfaction of his audience (which was not so large, unfortunately, as the importance of the subject dealt with merited), that though daylight is white light, white light is not necessarily daylight. He showed on the screen the spectrum of rays of the arc lamp, and pointed out that, though by combining certain sections of red, yellow, and blue it was possible to obtain a white light, this could not contain every section of each colour. Illustrating the use of screens for cutting out different sections, the author remarked that most modern sources of artificial light—especially gas—were deficient in blue, which, however, so far as seeing value was concerned, was of very small value, so that, if artificial daylight could be secured, it would not be of much use for ordinary purposes. Mr. Clark also showed in working and on the screen his own lamp for colour matching made on the absorption principle, and his spectacles for bringing the screen to the eye, instead of placing it on the lamp. As to the latter, he said he had tested the theory mathematically and experimentally, and thought this method would be a very useful alternative to the colour lamp. An experiment was made to show the correctness of his contention that a screen in front of the eye has the same effect as one fitted to the lamp itself. Among the slides thrown on the screen, it may be added, were a number illustrating good and bad lighting installations in practice.

Colour Matching Lamp arranged for Checking Samples of Cloth Materials.

[It is fitted so that it can be raised or lowered according to circumstances.]

DISCUSSION.

The President (Mr. J. Hewitt, of the South Metropolitan Gas Company) remarked that it was always a pleasure to hear Mr. Clark read a paper, as he invariably had valuable subject-matter to bring before them. The question of lighting interested the members of their Association to a very large extent indeed. Quite a good proportion of them were connected with the sales department, and Mr. Clark had shown them some of the methods by which one could present gas lighting in its best form.

Mr. S. B. Chandler (South Suburban Gas Company) said the members were to be congratulated upon getting Mr. Clark to come down and give them one of his instructive and entertaining talks. The paper was full of food for thought. With reference to lighting, it must, of course, not be forgotten that the gas companies were originally formed for the purpose of supplying light, in the old days before heating was thought of. One important point touched upon by the author was the number of shoddy burners to be found, which did not reflect any credit on the efficiency of the gas when used through them. It seemed to him that gas companies had recognized the urgency of this question, and, by means of attractive show-rooms and the encouragement given to makers of burners, were now in a position to offer to consumers the proper burner which was required for the purpose of their lighting. This was where the importance of the salesman came in. He it was who was usually called upon to advise; and if his advice was taken, satisfactory results were generally achieved. Shoddy gas-burners, he believed, emanated from a country with which England was at present at war; and as they had once become unobtainable, perhaps the market in them would never be revived again. As to the colour spectacles, these appeared to be an important improvement. He took it that the component parts of the glass were so merged in one another that a daylight effect was secured with lights containing a certain colour spectrum. But what occurred when another form of lighting was viewed through the screen? Was the daylight effect then produced? He was glad to see mention made of water heating, because this was already an extremely important matter, and was going to be still more important as time went on. The efficiency of appliances depended to a great extent upon the manner in which they were fixed. If one got a first-class boiler or circulator, fixed it in an approved manner, lagged the pipes and cylinder, and used a cut-out valve, he did not think better efficiencies could be expected than were now obtainable.

Mr. F. J. Pearce (North Middlesex Gas Company) remarked

that there was an interesting point in the paper about the very small percentage of the total heating value of the gas being used in producing light. It was stated that here was an horizon which would bear a lot of investigating. He took it the author had in mind the possibility of capturing a proportion at any rate of the waste heat which left lamps practically of every kind. It was a great pity that the cheap burners had ever been placed upon the market; but he thought perhaps the British public had themselves to blame. They liked to have a cheap article, and did not always stop to consider whether it would be the best to use. Under the heading of water heating another very interesting figure was given with regard to loss. As to this, the author said it was true that jacketed pipes might prove to be expensive; but when it was remembered that about 12 cubic feet of gas per hour was necessary to make up for the heat losses from 100 feet run of exposed pipe, it would be realized that the saving in gas would soon make up for it. This statement of Mr. Clark's was well worth bearing in mind. Probably many people did not quite realize that 12 cubic feet of gas per hour was in this way being absolutely wasted through radiation.

Mr. W. A. Vanner (Walton-on-Thames) said there were excellent incandescent burners on the market; but so far as the mantle was concerned, they seemed to be still at the original stage. Its composition appeared to be the same as when it was first invented. He thought that, with all the knowledge available in chemistry, it should be the aim of everyone in a position to do so to evolve some better substance for the mantle, and thereby make it stronger. Some time ago he had some burners shown to him by the representative of a well-known firm, who produced a very cheap specimen. On a remark being made that such a burner should not be upon the market, the representative admitted that it was a pattern which was never sold to gas companies, but only to small ironmongers and similar shops. It seemed that the gas undertakings could not prevent this sort of thing, however much they might try. The author admitted that he was rather chary of mentioning the originator of the modern gas-fire; and in this no doubt he was quite right. But it appeared to him (the speaker) that really the originator of the shallow fire could be traced back a long time to Fletcher, Russell, and Co.'s old "India" fire, which possessed an efficiency that he thought could be traced to the radiant heat obtained from the fire-brick back. There was also the Welsbach-Kern radiator. Here the "radiant" was really the original fire-clay tube of the Welsbach-Kern radiator. Another point to which he would like to refer, if it was not going too far afield, was the efficiency of the modern gas-engine. Within the last few years, they had witnessed the introduction of the two-stroke petrol engine. Could these principles be adopted with the gas-engine? If so, it would be a great thing.

Mr. W. E. Brown (Gas Light and Coke Company), alluding to the Fletcher "India" fire, said he gathered from old literature published by Mr. Fletcher that the superior efficiency was not put down to the fire-brick being so close to the front, but to the supposed advantage of the iron fret over the clay ball. To his mind, however, the efficiency really did arise from the fact that it was a shallow fire, not a deep one. Reference had been made to the waste of light through heating the mantle from the inside. He recollected having a discussion with a burner manufacturer on this very point, and suggesting an idea for getting over the difficulty, by the better splitting-up of the flame. His idea was, instead of having a long flame, as with the ordinary "C" burner, to have a burner-head in the form of a hollow fir-cone, pierced all over with small holes; so that, with the mantle fitted on, a better heating effect might be obtained on the mantle. The manufacturer said he would be pleased to carry out experiments at his (Mr. Brown's) expense; but they were doomed to failure, because the light radiating from the inside of the mantle would be lost. Now Mr. Clark said this was practically lost, so probably the burner maker was wrong. In connection with water heating, everyone said that pipes should be lagged; but in most cases he thought that they were not. The majority of people would not incur the necessary expense. Referring again to the heating of mantles, he noticed that the author mentioned surface combustion. What would the effect be if mantle ash were dusted on to one of these diaphragms? He had never seen it tried, and would like to know whether the author had. It seemed that the production by this means of what would be practically a solid mantle might prove a useful field for experiment.

Mr. D. J. Winslow (Lea Bridge) remarked that the paper was full of ideas, which was just what was wanted. He would like to ask whether the colour composition of the light from a mantle remained the same always, or whether it depended upon the gas in any shape or form, or on the flame temperature. With high-pressure lighting, they had a different flame temperature. Would the author's colour screen have the same effect with this lighting? With regard to water heating, Mr. Clark mentioned water-heaters with 101 per cent. efficiency. He took it this was probably due chiefly to the makers going on the net value of the gas used. They should endeavour to give the gross value of the gas in comparing efficiencies of different apparatus. It was not fair to the gas, in his opinion, to take the net value, considering they had so much potential heat in the shape of the water vapour that was condensed. It was astounding to learn how small a percentage of the potential energy of the gas they were able to convert to light. It seemed that somewhere about 2 per cent. of the value of the heat units in the gas was converted into useful work in lighting, even if they reckoned the efficiency at 30 candles per cubic foot; and with high pressure it was only brought up to about 4 per cent. If these figures were right, it was astonishing that they had not succeeded in doing better, in spite of all their improvements. It indicated the extent of the field that was open for the conversion of a greater amount of heat energy into light. It had been a matter of surprise to him to find that the efficiency of the cheap burners was rather good—from 15 to 20 candles. People who sold good burners often had cheaper kinds in their bags; but they did not show them to gas companies. Their argument was that shopkeepers would have these burners, and they might as well do the business themselves as leave it to other people.

Mr. Clark, in the course of a brief reply to the various points raised in the discussion, said that special screens, whether lamp-screens or spectacles, would have to be made for each type of lighting. What would serve for the incandescent mantle would not do for an electric arc lamp. No two types of lamp were so similar in colour value as to permit of the same filtering screen being used. In the case of the carbon filament lamp, for instance, the light was very much redder than the light from an incandescent mantle or a tungsten lamp; so it would be necessary to take out much more of the red rays than in the case of the mantle. This would necessitate a different type of screen. The colour of the light from a flat-flame gas-burner was almost identical with that from the carbon filament electric lamp, both being rich in the red. Mr. Brown had referred to the efficiency of the old Fletcher gas-fire being due to the use of iron as the radiating material. The radiation was really due to oxide of iron. The iron became coated with oxide, and the radiant heat came from this. If it were not for the oxide, the radiant heat emitted would be very small. It must be remembered, however, that these fires were the forerunners of the open-front fires. They had nothing in front of the radiating body. The removal of the iron bars from the front of the fire-clay radiants of a gas-fire made an enormous difference. The fact that the iron frets were not encumbered with iron fronts probably entirely explained the apparent superior radiating power of the iron frets. It was not due to superior radiation from the iron frets, but to the fact that there was nothing in front of them to prevent the radiant heat getting out. The point he had made about the waste of light on the inside of a mantle they might investigate for themselves in a very simple manner. All that was necessary was to place a mantle on an upright burner and have it arranged near a wall, or some other reflecting surface. On slightly turning the burner-head, a wave of shadow would be noticed against the wall. On close examination, this shadow-wave would be found to be caused by the shadows thrown on the wall by the meshes of the mantle itself. These shadows could only be produced by light coming from the inside of the mantle; and this showed conclusively that the light was there. The fact could also be demonstrated in other and more scientific ways; but the simple experiment just described seemed to be quite conclusive. A question had been asked as to whether mantle constituents had ever been used on the face of surface combustion diaphragms. So far as he knew, they had not; but he knew that metallic gauzes had been used in front, and they had yielded a very intense light. He did not doubt that something in this direction might be profitably investigated. In regard to Mr. Winslow's question as to the constancy of the colour value of various mantles, he had been favourably surprised with the remarkable constancy of colour that was obtained with different mantles. In a large number of mantles of various makes he had not detected differences which were of any importance whatever. They might regard the colour of the light produced by mantles as constant in every case, even with variation of adjustment of the burner. Theoretically they knew that if a flame was made hotter, the light from it ought to become slightly bluer; but within the range of the adjustment of any one particular burner this did not seem to have any important value. Of course, taking the extreme case of using an oxy-coal gas flame, one noticed a tendency for the spectrum to move towards the blue. With all ordinary low-pressure gas-burners, however, they could regard the light from the mantle as having a constant colour value irrespective of the quality of the gas. It might be inferred from this that all reputable mantle makers used the same materials and the same proportions. When referring to water-heaters giving 101 per cent. efficiency, he did not mention the reasons of these misunderstandings. Probably all of those present would appreciate them. The point was to know that the misunderstandings existed; and so long as they existed people would always be in a state of doubt as to how far they could accept comparisons that they had not made themselves. To take an instance, in the case of lamps, sometimes candle power at a particular angle was mentioned, which was not necessarily the candle power at other angles; and it was quite wrong to quote one angle without reference to the rest. It was really a matter of common-sense; but seeing that the misunderstandings did actually exist, it was important to bear them in mind. Allusion had been made to the remark in his paper about cheap upright burners giving fairly good efficiencies. It should be made quite clear that these were initial efficiencies—that was, taking the burner new. Owing to the slightness of construction of these burners, the depreciation in light-giving power was very rapid.

A hearty vote of thanks was accorded Mr. Clark for his paper, on the proposition of Mr. Vanner.

Mr. F. A. Frost (South Metropolitan Gas Company), in seconding, remarked that he had been very pleased to hear the references to shoddy burners. It would be well if gas undertakings could find adequate means to combat this trouble.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Broadstairs Gas Company.

SIR,—In the midst of a national crisis, one is not out to quibble about details of "£ *s. d.*" But when the details involve a principle and custom of long usage, then one must buckle to and speak out.

As you know, I never believe in a gas company paying lower dividends under the sliding-scale than Parliament has authorized. It is by no means a unique theory. To all acquainted with the history of the sliding-scale, it will be known that a long and weary road had to be travelled before the present basis was arrived at. But it was not travelled in vain; and in the principle arrived at, thanks to the untiring efforts of such a captain of our industry as Sir George Livesey, identity of interest between companies and their consumers has been permanently achieved since 1875. Consumers have every reason to be satisfied with their bargain, as facts and figures amply show since the introduction of the sliding-scale system; and results have more than amply fulfilled all expectations. Conjointly, they have shown without doubt that the company which does best for itself, does best for its consumers.

To quote a well-known treatise on the subject: "Under the combined effect of the sliding-scale and the auction clauses, the higher the dividend declared by a well-managed company, the sooner will come a reduction of price to the gas consumer, and the greater the share of the consumer in that reduction of price when it does come; because the higher the dividend, the greater the market price; the greater the market price, the larger the premium; and the larger the premium, the smaller the proportion of dividend-bearing capital." There one has the matter in a nutshell, or to again quote, it follows as the night the day, "other things being equal, anything which lowers the market price of a gas company's stock is a direct injury to its consumers; and it is against their interests to reduce the rate of dividend payable in respect of new capital." Sympathy with the consumer can be outdone.

Anyone familiar with company statistics is aware that the amount consumers have received in the shape of reduction in price since the sliding-scale came into operation far exceeds the amount won by companies by way of increased dividends. Indeed, the ratio generally runs about 5 to 1 in favour of the consumer. And so always admitting that inflexible basis, "due care and management," I contend that when a company finds itself in the position of being unable to pay the full dividend authorized by Parliament, the only fair and just way is to adjust the price of gas. Dark days come from time to time in the history of many companies; and it is entirely contrary to the spirit of the sliding-scale that they should not be tided-over in the manner suggested. The nature and consequences of the arrangement arrived at after so much travail were clearly understood; and while the consumers' interests were secured, it was not intended the shareholders' interests should be neglected.

In short, the principle of co-partnership and identity of interest was definitely founded, which means that a gas company, while reaping due reward for every decrease of price below a fixed figure, shall pay a fine for every increase of price above it. So just has it been in operation that no question of alteration has arisen except in outstanding instances where the matter of the standard price has been at stake. After all these years, then, one is suprised to come across a company which has constantly ignored the sliding-scale system.

As one interested in the welfare of the Broadstairs Gas Company, this lapse was not so noteworthy in previous years, in that dividends were received free of tax—a procedure not strictly legal, but perfectly admissible in this case, in that the dividends declared were below those authorized by Parliament on the basis of the sliding-scale. This, I may say, has been the custom of the Company for some thirty years or so. Judge of my surprise, therefore, to find that for the year ended Dec. 31, 1914, the practice had been suddenly broken, without warning. I say "without warning" advisedly, in that I scanned the advertisement for the stockholders' meeting without coming on anything untoward. True I later found (unfortunately after the shareholders' meeting) in casual type, in the Directors' report, that payment of dividend was recommended "less income tax." But surely custom so long established should not have been so shyly abandoned, to the disadvantage of shareholders. That the matter would be dealt with at the meeting by the Chairman is not sufficient answer. Many shareholders cannot attend, and no report has since been issued explaining the cause of such departure. Without direct inquiry, therefore, they must remain in the dark; and to say the least of it, I consider the Directors have treated the shareholders with scant courtesy.

But this is not all. As I have already pointed out, the Company is one (happily of the few) who have ignored the sliding-scale system, although, be it noted, in sale particulars of shares, it is stated that the "sliding-scale is applicable to the Company's operations." Thus by parliamentary authority the "C" and "D" stocks are subject to a rise or fall of dividend at the rate of 3s. 6d. per cent. per annum for every variation of 1d. per 1000 cubic feet charged for gas below or above the standard price of 4s. 4d. per 1000 cubic feet. At the selling price of 3s. 3d. per 1000 cubic feet for the year ended Dec. 31, 1914, it will be clear the statutory dividend would be 9 11-40ths per cent. per annum on the stocks in question. Instead, a dividend of 7 per cent., as in the year before, was declared, and as long as this was "free from tax," one might have been partially consoled. At the present rate of tax, 2s. 6d. in the pound, the distribution on the "D" stock would have been equivalent to a dividend of 8 per cent., less tax. But now we have been suddenly shorn of the consolation of the Company's established practice; and a dividend warrant at a lower figure fell like "a bolt from the blue." If the earnings of the Company compelled such radical departure from precedent then, firstly, I consider special notice should have been given—especially as the difference between the long-established custom of over thirty years and that now complained of represents *for 1914 a reduction of 1 per cent. dividend to the shareholders*—a fact not likely to be appreciated at the first glance but none the less so when the true position is realized, and a most ingenious way of leaving the shareholders under the impression that no alteration in dividend has taken place. And, secondly, I contend a juncture has now been arrived at when such an adjustment of the selling price should be determined on as to render such a step unnecessary, and truly bring the Company's operations within the scope of the sliding-scale and its obvious spirit. In short, it is time the shareholders' interests evinced some measure of practical sympathy.

Finally, I cannot close without drawing attention to a rather curious feature in the particulars which were issued by the Company for their latest sale, which took place on Jan. 19 last—that is, nineteen days after the close of the last financial year. Here we find, in bold and prominent type in two distinct positions, the following expression wholly or partially given in connection with the new issue of "D" stock: "These dividends have been paid free of income-tax; so that at the present rate (2s. 6d. in the pound) the distribution on the 'D' stock is equivalent to a dividend of £8 per cent., less tax." This statement veritably speaks for itself; its lure for the prospective investor obvious. After this proclamation, as it were, from the housetops of the virtue of the Company's custom of old, how are we to assimilate the fact of the lapse for 1914 when the potential words "less income-tax" for the first time appeared in the Directors' report? The legitimate attraction of buyers is one duty; the conservation of established principle and the maintenance of the interests of old and new shareholders is surely more important, or was the new *régime* for 1914 so speedily forgotten? Further comment would be superfluous; and I can only express my great personal surprise at such mysterious, to say the least of it, conduct of the Company's affairs. I do not intend to let the matter drop until the general body of shareholders appreciate what has happened, in the hope that the future policy of the Company shall be more controlled by the proprietors.

Under the Directors' present policy, we shareholders are losing over £1400 annually in dividends, and as 1d. per 1000 cubic feet on the sale of 88 million cubic feet (this being the sale of gas for 1913—the total sale for 1914 not being given in the sale particulars in question) represents over £366 13s. 4d. per annum, the adjustment is obvious.

Aldershot, April 30, 1915. R. W. EDWARDS ["NONULUS"].

Benzol Extraction on Gas-Works.

SIR,—I noticed in your last issue that Mr. Butterfield believes that benzol extraction on gas-works may be continued after the war.

You will be interested to know that, in conjunction with Mr. G. C. Pearson, I am hopeful of perfecting a method by means of which the gas will be denuded of its valuable oils—such as benzol, toluene, and xylene—which will be replaced by more permanent calorific and illuminating constituents of lower market value.

One means would be to crack-up a suitable cheap oil, either by an already-known method or one to be yet devised.

Birmingham, May 2, 1915. E. W. SMITH.

Essentials of Modern Gas Composition—Mr. W. Cranfield on Density.

SIR,—May I be permitted to make a comment on that part of Mr. Cranfield's paper (as above) which deals with density.

On p. 40 of your issue of April 20, Mr. Cranfield is reported to have said:

> "As a check on quality, a test of density had been suggested; and this was actually carried out on some works. Of all suggested checks, he regarded this as the most mischievous, because the most unreliable and misleading. It appealed to a desire for an easy, automatic, and self-recording test. If perfectly uniform conditions of working could be ensured and maintained, a fall in the density of the gas might reasonably suggest, if not directly evidence, a fall in value.
>
> "An increase of the undesirable incombustible constituents—carbon dioxide and nitrogen—will put up the density, as also will an increase of valuable hydrocarbons. An increased amount of indrawn furnace gases may thus mark a shortage of hydrocarbons, and may even seem to denote an enhanced value because of an enhanced density. Most extravagant claims have been made for this test, and the security it may afford an engineer."

Dealing first with the statement that "most extravagant claims have been made for this test and the security it may afford an engineer," I cannot do better than refer Mr. Cranfield to an editorial comment made ["JOURNAL," Dec. 24, 1912, p. 948] upon Mr. Jacques Abady's article on pp. 956-60 of the same issue, entitled "Calorific Control of Gas Making: Its Use and Limitations."

> "Two gases having equal calorific power, but unequal compositions, may require a different proportion of air for complete combustion, and therefore the introduction of varied quantities of nitrogen, which varied volumes affect flame temperature. This is well known; but it is at the very root of Mr. Abady's contention for tests auxiliary to the calorific power one, in order to control the industry's primary product of coal carbonization.
>
> "As to the nature of these supplementary tests, most of them are carried out in the larger undertakings, but in some cases there is evidence of perfunctory or careless performance or the application of unreliable methods. The collected data included in the article indicate that there are existing these vitiating conditions. It is also found from the published data that tests most important to working and quality efficiency are apparently totally neglected on some works. For instance, there are works in which the specific gravity of the gas is never taken; and yet this is a very simple and handy index to the percentage of carbon dioxide and nitrogen in the gas, though, of course, with an increase of calorific power, there should also be an increase in specific gravity.
>
> "Supplementary to the calorific power test—to put the matter briefly—Mr. Abady would have, in the interests of working and

quality efficiency, the net calorific value as well as the gross, in order to furnish a guide as to the percentage of hydrogen, the specific gravity continuously recorded, a complete analysis made of the gas, as well as a determination of the carbon density of the unsaturated hydrocarbons. He advocates, too, the working of a continuous specific gravity indicator side by side with a calorific power recorder.

"These are the supplements that he would make to the calorific test, so as to ensure the thorough control and maintenance of the highest working results—in respect of quality—to the advantage of both supplier and purchaser. It is all excellent; and the arguments adduced in the article are in this respect incontrovertible."

The claim made in the article, of which the above is your editorial comment, is the claim that has always been made.

The real object of the gravitometer is to keep a control upon that one factor which Mr. Cranfield urges is so important—*i.e.*, to prevent an increase of undesirable incombustible constituents, such as carbon dioxide and nitrogen. Such an increase immediately increases the density very materially, and is shown unmistakably and at once upon the gravitometer chart or scale.

On the other hand, if a jet photometer or recording calorimeter is used, all that the attendant can see is either a drop or a rise. He knows not why or how such a drop or rise has occurred, and he may take steps to bring the quality up (as, for instance, by enrichment) without detecting or curing the real cause—namely, excess of incombustibles. The result is a wasteful method of gas production.

Mr. Cranfield says it has been stated that gas with more than 39 per cent. of nitrogen was sent out from one of the Leeds gas-works. Now Leeds gas has to comply with a standard of illuminating power, and presumably this particular gas did so. How would it have been possible for a gas with 39 per cent. of nitrogen to have been sent out if the density had been recorded and the record intelligently used? The fact that it was sent out shows that an illuminating power test (or a calorific power test, if it comes to that) is no check on such excess of incombustibles.

Where Mr. Cranfield has gone wrong (if he will permit me to say so) is to assume that it has ever been argued that the density can be considered by itself, and is the only factor to be taken into consideration. No single factor in gas production can be considered singly. If Mr. Cranfield only looked to the factor of his "make per ton" without considering the quality of the make or the bye-products yield, where would such a process of running a gas-works in blinkers lead him to? Surely not to the winning post of successful management.

To sum up in colloquial language, it appears to me that Mr. Cranfield thoroughly recognizes the importance of keeping down the percentage of incombustibles, but with respect to the particular matter with which this letter deals he appears to have set up an "Aunt Sally" of his own make and proceeded to pelt at it.

JNO. F. SIMMANCE.

Westminster Palace Gardens, S.W.,
April 27, 1915.

Aspects of Co-Partnership.

SIR,—Reverting to the editorial note in your issue of April 13, on "Aspects of Co-Partnership," it appears to me (as an employer of labour who has closely followed the co-partnership scheme introduced by the late Sir George Livesey into the South Metropolitan Gas Company, and later, with modifications, by Sir Corbet Woodall and introduced into the Gas Light and Coke Company) that the systems of co-partnership in vogue in both these Companies have totally failed.

It was apparent to any business man that making the workers' share practically dependent upon the cost of raw material at the works was inherently bad, and bound to fail at such a time as the present, when raw material has risen to such a point that the share of the worker is almost entirely wiped out. In such circumstances, raw material can always beat the worker, and no doubt he is aware of it.

This is not co-partnership in its true spirit at all; and it is obvious that the ideal system has yet to be introduced—at any rate, into our two largest gas companies.

EDGAR O. GUTTRIDGE.

24, *Sandmere Road, Brixton, S.W.,*
April 28, 1915.

"Silly Theory" on Gas-Fire Heating.

SIR,—I have only recently read your editorial comments [see "JOURNAL," March 16] on my letter of the 12th of March. From your remarks, it would appear that my tests were carried out with a view to finding the percentage of radiant heat developed by a gas-fire. This was not so; and consequently the figures and particulars of experiments which you give have no bearing on the matter at all.

My experiments were made merely to compare the efficiency of three methods of heating a room—coal, gas, electricity. You will admit that, after all, the actual value of any method of heating is fixed by its practical efficiency in everyday use; and my experiments were made in this direction.

The gas-fire used was a 1914 pattern, built by one of the most eminent makers of gas-fires in this country, and compared very favourably with many others of which I got particulars.

It would clear away a doubt in the minds of many if you would state definitely what the gas consumption per hour should be to raise the temperature of a 1000 cubic feet room 10° Fahr.

R. WEAVING.

Hollinwood, Lancs., April 26, 1915.

[Mr. Weaving has shifted his ground. In his original letter, he spoke of an "estimated efficiency" of 27 per cent.; and he asked where the other 53 per cent. went to. Now he says that, from our comments on his previous letter, "it would appear that my tests were carried out with a view to finding the percentage of radiant heat developed by a gas-fire. This was not so." If he did not ascertain the percentage of radiant heat, there was something defective about his method of obtaining the elements to show the efficiency of the gas-fire. He spoke in his last letter of "estimated efficiency," and now of "experiments." We repeat the request for details of the conditions, apparatus, and methods employed in making the experiments with the gas-fire, to place in contrast with the defined conditions, apparatus, and methods employed by men of high scientific standing in determining actual gas-fire efficiencies. Mr. Weaving shies at answering our questions as to whether he has anything to say against the competence of the men named in our last comment, as to whether his own capacity for testing fire efficiencies is superior to theirs, and as to whether the apparatus and methods he adopted outranged theirs in accuracy. We beg of Mr. Weaving to deal with the points raised by us, and not to imitate electrical predecessors in controversy on this point by adopting the course of evasion. If he cannot deal with the points raised, this will help to show the absurdity of the estimated 27 per cent. efficiency of which he spoke. But we are hoping that, if he cannot show the incompetence of the men quoted by us, and the error of their results, he will at least have the courage and the manliness to say, in all quarters where his paper was published, that he did an injustice to the gas-fire in his paper, and will withdraw the ridiculous estimate of 27 per cent "efficiency." In the last paragraph of his letter, Mr. Weaving says it would clear away a doubt in the minds of many if we would settle definitely what the gas consumption per hour should be to raise the temperature of a 1000 cubic feet room 10° Fahr. The answer, of course, is that the gas consumption depends on the rate of ventilation of the room, and the materials of which the walls and any articles in the room are constructed. If Mr. Weaving wishes to raise by 10° Fahr. the temperature of the air in a 1000 cubic feet room which is perfectly insulated and unoccupied by persons or furniture, &c., we can tell him that he would require about 0·37 cubic foot of gas of only 500 B.Th.U. per cubic foot, costing at 3s. per 1000 cubic feet 0·0133d. If he preferred to use current at 1d. a unit to warm the air of the same room to the same extent, he would have to expend 0·0535d., or four times as much as for gas at 3s. per 1000 cubic feet. If he ventilates the room, whether through the walls or by a flue-pipe, or if he has not a perfectly insulated room, he will in either case have to make up the heat losses by a proportionately greater consumption of either gas or current. He cannot assume in either case that ventilation is unnecessary, and that it can be done sufficiently by electricity at a much less expenditure than 25 per cent. of the current consumed in heating, and 25 per cent. is, as already indicated in our reply to his letter in the "JOURNAL" for March 16, p. 673, about the proportion of the heat of the gas consumed in a gas-fire which is expended in ventilating the room. Thus with gas at the comparatively high price of 3s. per 1000 cubic feet, and with current at the low price of 1d. per unit, gas remains four times cheaper than current for heating and ventilating any given room. Our correspondent will be interested in an article in another column dealing with some practical tests of gas and coal fires for heating at the Manchester Town Hall. It will be observed that the Electricity Committee were not eager to let electric radiators enter into competition, and they exercised a wise discretion.—ED. J.G.L.]

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Ammanford District Council, Skegness Gas.

Bills reported, with amendments: Altrincham Gas, Northwich Gas, Sutton Water.

Bills read the third time and passed: Brighton and Hove Gas, Frimley and Farnborough District Water, Ormskirk Gas and Electricity, Sunderland Corporation (Wearmouth Bridge), Warwick Gas.

The order recently made appointing certain Lords a Select Committee on the Ashington District Council Bill [see *ante*, p. 155] has been discharged, and a fresh Committee constituted as follows: The Marquis of Bath (Chairman), the Earl of Verulam, the Earl of Kilmorey, Viscount Barrington, and Lord Rotherham. The Committee will commence sitting to-morrow.

The Select Committee appointed to consider the Yorkshire Electric Power Bill have reported that the promoters do not intend to proceed further with it. [A report of the proceedings before the Committee appears elsewhere.]

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Brighton and Hove Gas, Frimley and Farnborough District Water, Ormskirk Gas and Electricity, Sunderland Corporation (Wearmouth Bridge), Warwick Gas.

Bill read a second time and committed: Ilfracombe Gas [Lords].

Bills reported, with amendments: Barnoldswick Water, Chelms-

ford Corporation Gas, Metropolitan Water Board, Southend Water.

Bill read the third time and passed: Ammanford District Council.

A Bill to confirm Provisional Orders made by the Board of Trade relating to Oakham, Staveley, and Thirsk Gas and Thirsk District Water was presented last Thursday, read the first time, and referred to the Examiners.

On the consideration of the Dewsbury Corporation Bill to-day, a motion will be made for the insertion after the word "auditors" in clause 119, giving power to the Corporation to appoint additional auditors, the words "or accountants approved by the Board of Trade."

The petitions presented by the Bracebridge Urban District Council and the Branston and Welton Rural District Councils against the Lincoln Corporation Bill have been withdrawn; as is also that of the Board of Conservators for the Fishery District of the River Wear and Mr. T. C. M'Kenzie against the Weardale and Consett Water Bill.

The Aniline Dye Question.

Mr. JOWETT last Tuesday asked the President of the Board of Trade if he would give particulars of the steps he had taken, if any, since the 10th of March (irrespective of the encouragement he had given to the flotation of a new dye company) to facilitate the conveyance of crude bye products from this country to Switzerland for the purpose of being manufactured into aniline dyes.

Mr. RUNCIMAN: I shall be glad to give my hon. friend particulars of the steps taken in this matter, but I think it inadvisable to enter into details in answer to a question.

Mr. BOOTH asked whether British Dyes, Limited, had decided to purchase the business of Read Holliday and Sons; and whether any Director or any member of the Committee who formed the Company would receive a commission from either party.

Mr. RUNCIMAN: The answer to the first part of the question is in the affirmative, and to the latter part in the negative.

In answer to a question put by Mr. PENNEFATHER on Thursday in regard to British Dyes, Limited,

Mr. ROBERTSON said: The number of shares in British Dyes, Limited, allotted up to yesterday was, I am informed, 641,509. The consequent liability on His Majesty's Government is to advance £641,509 on debentures, together with a loan of £200,000 to Read Holliday and Sons, Limited, which will be treated as an advance to the new Company on its acquisition of that undertaking. The only amount so far paid by His Majesty's Government is £56,011 15s. 1d. in respect of the loan. The Government have also undertaken to make a grant to the new Company not exceeding £100,000 altogether in respect of expenditure incurred by them on research within the next ten years. I understand that the Directors of British Dyes, Limited, have decided to acquire Read Holliday and Sons, Limited, exercising for the purpose option (*a*) set out in the prospectus. I have seen it stated in the Press that Mr. Joseph Turner will continue to manage the business; but I have no information as to the terms made with him.

The Supply and Price of Coal.

Mr. ANDERSON on Wednesday asked the President of the Board of Trade whether he was now in a position to make a fuller statement as to the intention of the Government regarding the supply and price of coal, and to what extent they proposed to adopt the recommendations of the Departmental Committee.

Mr. RUNCIMAN: I am in communication with the London County Council regarding the Committee's recommendation in favour of the accumulation of a stock of coal in London. The rates of freight on the interned steamships have been largely reduced. The recommendation regarding the utilization of prize ships has been brought to the notice of the Prizes Disposal Committee. The recommendation in favour of restricting the export of coal to neutral countries raises very difficult questions which are now receiving my careful consideration. I expect to be able to announce the decision very shortly.

CHELMSFORD GAS BILL.

The Unopposed Bills Committee of the House of Commons, presided over by Mr. WHITLEY, on Tuesday last passed the preamble of this Bill.

Mr. CROWTHERS (Messrs. Hargreaves and Crowthers, Parliamentary Agents) said the Bill provided for the transfer to the Corporation of the Chelmsford Gas Company's undertaking, and conferred further powers on the Corporation in regard to the gas undertaking. The Chelmsford Gas Company promoted a Bill last session to incorporate itself into a parliamentary company, to considerably extend the limits of supply, to use additional gas lands, erect new and enlarged gasholders, and to increase the capital and borrowing powers. The Bill was passed, and sanctioned additional capital and borrowing powers to the extent of £85,700. Clause 51 of the Company's Act gave the Corporation the right to promote a purchasing Bill this year; hence the present measure. The purchase price was to be determined by arbitration. On the financial proposals of the Bill, the Local Government Board had presented a report in which it was suggested that a period of 35 years for the repayment of the purchase money was too long. This period, however, was quite a usual one for the purpose. The Local Government Board in their report quoted eleven cases, and in six of them 35 years was allowed. In the case of the portion of the Wakefield area transferred to Ossett, which was not mentioned in the report, 40 years was allowed. Since the report was issued, the Skegness Bill had been passed, with 35 years allowed. As to the cases in which the periods had been less, these were all instances in which no plant was purchased, but only mains.

Mr. *William Newbigging* said that the existing works were sufficiently large to deal with the present demands. They were in fair order; but the Corporation had been recommended to reconstruct them.

In answer to questions by the COMMITTEE, witness said the arbitration would be on the basis of a going concern, regard being had to the condition of the plant.

The CHAIRMAN said the Committee were satisfied with the period of 35 years for the repayment of the purchase money.

Witness, continuing his evidence with regard to the loan periods for plant, mains, stoves, meters, &c., said it was necessary to immediately instal a new gasholder. The total cost of this was estimated at £10,100; but the first outlay would be from £7500 to £8000, as one lift only would be required at the beginning. The maximum day's output was 360,000 cubic feet; but the present storage capacity was only three-quarters of this amount, whereas gas engineers held that storage equal to the full maximum day's output should be provided. An arrangement had been made with the Company to go on with the installation of this holder. Retorts and other works were also urgently needed; and he regarded the estimate of £36,000 as quite a reasonable figure. It would not last the Corporation for more than ten years.

Mr. E. MOON, K.C. (the Speaker's Counsel), pointed out that the Corporation were asking for 40 years for new plant, 30 years for mains, and 20 years for meters, stoves, fittings, &c. These were all rather long periods.

Mr. CROWTHERS said 40 years was the usual period for new plant. It was granted in two of the cases mentioned in the Local Government Board report—viz., Ellesmere and Margam.

In reply to Mr. MOON, who asked what was the life of a gasholder, witness said that he had holders on his works which had been up for 50 years, and were in good condition to-day.

The CHAIRMAN: But a retort-house does not last much more than ten years.

Witness said that the retort itself did not last much more than three years, and was renewed regularly from revenue. The bench containing the retort, however, lasted a great deal longer.

The CHAIRMAN pointed out that the Local Government Board suggested that the length of the periods for borrowing should be left to be determined by them.

Mr. CROWTHERS said that in the present case, the work had to be carried out immediately; and as the Corporation were before Parliament, it was felt this was the proper body to deal with the matter.

The CHAIRMAN then referred to the proposal of the Corporation that 30 years should be granted for mains.

Mr. CROWTHERS said there were two cases in which the Local Government Board had allowed 30 years; and this year Skegness had been allowed the same period by a Select Committee.

Witness said he would put the life of a main at 40 years, and longer at Chelmsford, because the subsoil was very good for gas-mains. Any size main had a long life, especially on a clay subsoil.

Mr. CROWTHERS, dealing with the proposal to allow 20 years, said that Ellesmere had been allowed 15 years and Mynyddislwyn 20 years. Perhaps 15 years would be a fair figure.

Witness said he did not consider 15 years too long for cookers and stoves; and as to meters, there were hundreds of thousands which had been in use for 35 or 40 years.

The COMMITTEE eventually decided to allow 40 years for plant and 30 years for mains, as asked in the Bill, but reduced the 20 years for stoves, meters, and fittings to 15 years.

LURGAN URBAN DISTRICT COUNCIL BILL.

This Bill was considered last Wednesday by the Local Legislation Committee of the House of Commons, under the chairmanship of Mr. MIDDLEBROOK.

Mr. VESEY KNOX, K.C., and Mr. JEEVES appeared for the promoters. There was no opposition.

Mr. VESEY KNOX said the main object of the Bill was to acquire the gas-works of the Lurgan Gaslight and Chemical Company, which was a non-statutory undertaking and had supplied gas in Lurgan since 1848. The Company had been very successful financially, but, he was afraid, not equally popular—whether rightly or wrongly it was not for him to say, as they had now agreed to sell their undertaking. Nearly all the mills in the district used electricity, which they generated themselves; there being no public supply. In 1913, however, a proposal was made by some of the shopkeepers to start a non-statutory electric supply company, to supply by means of overhead wires. The Council, however, did not think this course desirable, and themselves promoted an Electric Lighting Provisional Order. This was subsequently granted after strong opposition by the Gas Company, who the same session promoted a Bill asking for statutory powers. Negotiations for purchasing the Company were then commenced, as it was felt that the gas and electric undertakings in a town of this size could be better worked together. The Council were not desirous of purchasing by arbitration. They eventually—acting under the advice of Mr. C. F. Spencer and Mr. Frank Jones—agreed to purchase the Company's undertaking for £40,000; and an agreement to this effect was duly scheduled to the Bill. The agreement was made in June, 1913, and the gentleman who drafted it, by almost uncanny prescience, foretold the present state of things, for he inserted a most unusual clause, providing for the carrying on of the undertaking by the Company in the event of the purchase money not being paid by the date of transfer. Thus, the undertaking would be carried on notwithstanding the effect of the war as regards the Treasury clause. The Irish Local Government Board approved of the purchase; and he thought the Committee would be satisfied that the purchase was a desirable one, even under war conditions. The sale of gas for 1913 (the year in which the negotiations took place) was 41¾ million cubic feet, to which figure it had increased from 32 millions in 1908. Thus, the price of the works was less than £1000 per million, which was a very reasonable capitalization, and less than was usually awarded in arbitrations. There were at present 1900 consumers; but the works were more than adequate for present needs. The capital expenditure shown by the balance-sheet was only £27,000; but of this £7600 had been incurred since 1911. Therefore a good part of the works was new. There was

no doubt the works had cost a great deal more than the capitalization shown, and, further, the Company had earned very much more than they had divided. The greater part of the capital expenditure must have been found out of profits. In 1912, the profits amounted to £2634; in 1913, they were £3311; and in 1914, they were £3496. In each year, however, the Company had only divided 7½ per cent. (except in 1914), which was less than £1000. From these figures it would be seen that the purchase price was only 13¾ years; and in his experience of arbitrations he knew of no case in which so low a multiplier as this had been fixed. In the neighbouring town of Lisburn, in which similar gas-works were purchased by the Local Authority, the capital cost, including some subsequent expenditure, was £57,000. Nevertheless, the Lisburn Council were satisfied, and last year made a profit of £1000 after meeting capital charges. The present maximum price in Lurgan was 4s. 3d. per 1000 cubic feet; but the Council's Engineer felt that a higher maximum might well be fixed, having regard to the increased cost of coal and labour at the present time. The charge to consumers was 3s. 10d. It was contemplated spending £5000 on new plant, mains, &c. The limits of supply proposed in the Bill were slightly less than those of the Company. They were, however, considerably greater than the municipal boundaries. A large part of the outer area was rural; but there were two or three manufacturing villages. It was the intention of the Council to run the electricity and gas undertakings together; and by clause 59 of the Bill it was proposed to repeal section 8 of the Council's Electric Lighting Order. This, the Northumberland clause, was put in at the request of the Gas Company. The Board of Trade had made a special report on the matter, from which it would appear that the Board had no sort of confidence in the clause, but put it in according to their usual practice, in deference to the views of Parliament, because the Gas Company asked for it. This was the general rule now. The Board, however, did not take exception to its repeal in the present case, as the Company were to be wound up.

Mr. *Frank Jones*, Consulting Gas Engineer to the Council, agreed that the price of £40,000 for the Company's undertaking was very reasonable. The works were in good condition—the retort plant being comparatively new. The undertaking should be very successful in the hands of the Council. There was no immediate need for large extensions of plant, and only mains extensions would have to be provided for. As to the calorific value testing clauses, these had been altered to a certain standard—viz., 500 B.Th.U.—without any margin before the penalties commenced. This was the form of clause preferred by the Board of Trade, and he also favoured it in preference to the standard of 540 B.Th.U. with a margin of 7½ per cent. As to the maximum price of 4s. 3d. per 1000 cubic feet, this appeared rather low in present circumstances. With regard to the borrowing powers, apart from the purchase money, the figure of £5000 for extensions was made up as follows: Extension works, £1200; services, meters, stoves, &c., £2000; mains, £1800. For this sum and for the £40,000 purchase money a period of 40 years was asked. For the purchase price, the period of 40 years was usually allowed; and the Irish Local Government Board made no comment. As regards the £5000 for works and £2000 working capital, the Local Government Board had suggested that the period should be left to the Board to determine. This, however, was not the practice when specified sums were named and the purposes to which they were to be put set out, as in this case.

It was intimated, on behalf of the Local Government Board, that the point would not be pressed. The suggestion as to leaving the periods to the Board was made before it was known that detailed estimates as to the purposes to which the money was to be put had been prepared. The periods in the Bill were regarded as satisfactory.

Mr. *C. F. Spencer* gave formal evidence in support of the Bill.

The Committee passed Parts II. and IX., dealing with the gas undertaking and financial powers as set out above. They substituted 4s. 6d. for 4s. 2d. per 1000 cubic feet as the maximum price for gas.

SOUTH STAFFORDSHIRE WATER BILL. WOLVERHAMPTON CORPORATION WATER BILL.

The consideration of these Bills was commenced on April 19 by a Committee of the House of Lords, presided over by the Duke of Wellington. The Committee sat daily until last Thursday.

It is proposed to construct two new wells in a district adjoining the South Staffordshire Company's present area of supply, and, in consequence, to add some thirteen parishes to the Company's area, in some of which a supply is already given. On the other hand, the Wolverhampton Corporation by their Bill propose to sink a well in an adjacent portion of the same area and to add about half the parishes to their area of supply. Hence, the two Bills, being competitive, were taken together. The Staffordshire and Worcestershire Canal Company and the Cannock Rural District Council also opposed the South Staffordshire Bill.

By sinking the proposed two wells, the South Staffordshire Company contemplate being able to secure an additional 2,000,000 gallons of water per day. The Bill also proposes to raise £150,000 additional capital, or a total of £241,000 with the existing unused capital powers. Whereas the Company's proposed wells are to be in the parish of Brewood, the Wolverhampton Corporation's proposed well is to be in Lapley, an adjoining parish; and to this there was considerable local opposition. There was no such opposition, however, to the South Staffordshire Bill. At the same time, it was pointed out for the Water Company that, owing to the configuration of the ground, their wells would not interfere with those of the Corporation. The opposition of the Canal Company was on the ground that water would be abstracted from the canal, and that there were suitable sites inside the Water Company's area where wells could be sunk. The Cannock Rural District Council opposed because an arrangement had been entered into with the Wolverhampton Corporation agreeing to that body supplying in some of the districts which the Water Company proposed to add to their area of supply. The Rural District Council argued that the territory comprised in the two Bills could very well be divided-up between the two parties.

The bulk of the time of the Committee was taken up with landowners' objections; but, as will be seen from the decision below, no concessions are to be made to them.

The Chairman, in announcing the Committee's decision last Thursday, said that the preamble of the South Staffordshire Company's Bill was proved. As to the Canal Company's opposition, the Water Company must pay for any damage done to the canal, but the onus of proof of damage must be, in the ordinary way, on the Canal Company. The limit of protection to landowners would be two miles. The wells must be lined to a depth of 100 feet or 150 feet, upon which point the promoters would no doubt be able to agree with the opponents. With reference to the Wolverhampton Bill, the Committee found the preamble proved; but the limit to the water to be drawn from the new well must be 1½ million gallons. The districts in the added area already supplied by the South Staffordshire Company were to be continued to be supplied by the Company; while it would be more conveniently settled by agreement as to how the remainder should be supplied. The two-mile limit also applied to the Wolverhampton well, which must be lined down to the bottom of the sandstone.

ROAD REINSTATEMENT AFTER MAIN LAYING.

Suggested Clause in the Metropolitan Water Board Bill.

In view of the opinion held by some borough surveyors that local authorities should take over the filling-in of trenches after gas and water mains have been laid or repaired – in addition to reinstating the surface of the road—a decision on a clause which it was suggested should be inserted in the Metropolitan Water Board Bill last Thursday is interesting.

As already reported in the "Journal," the Board have obtained powers to lay a large main—42 to 46 inches in diameter—from a new pumping-station in Surrey to several existing reservoirs in the South of London. Under the Metropolis Management Act, local authorities in London could, if they desired, take over the filling-up of the trenches as well as the reinstatement of the roads. As a matter of practice, however, this has not been done hitherto.

Mr. Jeeves, for the Lewisham and Wandsworth Borough Councils, asked the Committee to apply the terms of the Metropolis Management Act to the new aqueduct.

Mr. Vesey Knox, K.C., for the Water Board, strongly objected to this—first, on the ground that no local authority had ever put into force the sections of the Act dealing with the point, and, secondly, on account of the complications which would arise if they did. There was grave risk, he said, if the local authority did the filling-in, that the Board might have to pay for damage to other pipes already in the roadway which was caused by the local authority. At any rate, it would have to be determined whether any damage done to other pipes was by the initial act of the Board in the actual laying or the subsequent filling-in of the trench by the local authority. He foresaw endless trouble, and the filling-in was certainly a responsibility which should be borne by the water or gas authority.

The Chairman said the Committee did not think the filling-in was work which should be done by the local authority. The reinstatement of the road, on the other hand, should be.

Eventually it was decided to insert a clause giving all the local authorities concerned the right to reinstate the surface; leaving the filling-in of the trench to the Water Board.

YORKSHIRE ELECTRIC POWER BILL.

HOUSE OF LORDS COMMITTEE.—Thursday, April 22.

(*Before Lord* Hylton, *Chairman*, *Lord* Weardale, *Lord* Avebury, *Lord* Eldon, *and Lord* Falkland.)

This Bill proposes to confer upon the Yorkshire Electric Power Company authority to supply electricity in detail for lighting purposes in those portions of their area where at present they have only powers to supply in bulk, and where there is no Electric Lighting Provisional Order in force.

Counsel for the promoters were Mr. Freeman, K.C., and Mr. Tyldesley Jones. There were a large number of opponents, including the following Gas Companies: Penistone and District, Calverley and Horsforth District, Otley, and Yeadon and Guiseley, all of whom were represented by Mr. Wedderburn, K.C., and Mr. Jeeves. In addition, the Leeds, Sheffield, Rotherham, Huddersfield, Wakefield, Halifax, Bradford, and Barnsley Corporations, the Brighouse District Council, and the Great Northern Railway Company opposed.

Mr. Freeman, in opening, said the Yorkshire Electric Power Company were incorporated in 1901, and were granted an area consisting of the greater part of the West Riding of York, in which they were empowered to supply electricity in bulk to authorized distributors, and to any person for power purposes who could use up to 20 per cent. of the total quantity of electricity so taken for lighting purposes. In regard to the areas of the large county boroughs, however, the Company could not supply without the consent of these county boroughs; whereas in the case of a company's area the Power Company could go to the Board of Trade and ask whether, in the event of a consent to supply being withheld, this consent was unreasonably withheld. The position with regard to the county boroughs who were now opposing was on the question of competition in the districts adjoining their boundaries, where, under the Electric Lighting Acts, these county boroughs could supply electricity with the consent of the Board of Trade. Coming to the opposition of the gas companies, Counsel said they were opposing really on a clause matter.

Mr. Wedderburn: The gas companies do not oppose on a clause matter except so far as the striking-out of clauses 12 and 13—the vital

clauses of the Bill—are concerned, and which the Board of Trade recommend should be struck out.

Mr. FREEMAN, continuing, then dealt with the gas companies' petitions. The general purport of these was, he said, that the Power Company would not be subject to many provisions, if they were granted these wholesale powers to supply electrical energy for lighting in the gas companies' districts, which ordinarily under the Electric Lighting Acts they would be subject to. The gas companies, it was said in the petitions, did not fear competition from electricity in their areas, providing the electric supply company was subject to the same or similar obligations to give a supply wherever it was demanded in accordance with the statutory provisions of the industry. If clause 12 of the Bill were to become law, it was said the Power Company would be able to refuse to meet the less profitable demands from the smaller consumers and lay itself out to meet the more lucrative customers, and thus do considerable injury to the gas undertaking. This point of view, however, did not now hold, because, since petitions against the Bill had been lodged, terms had been arranged with all the local authorities concerned, as well as the county council, that in the event of a supply not being given in the districts scheduled to the Bill within five years, an application could be made to the Board of Trade to take away from the Power Company the authority to supply. The provisions of the Electric Lighting Acts were largely embodied in the Bill, and thus the Power Company would be under all the statutory restrictions which every lighting company had to comply with. The question was also raised in the gas companies' petitions with regard to the financial position of the promoters; and he would welcome any inquiry into this. The Company started in 1903, at which time 99,000 of their £1 shares were subscribed; by 1914, 271,640 £1 shares had been subscribed; in 1906, £277,816 had been spent on capital account, while the gross receipts in that year were £4662—there being a loss of £1860. By 1914, however, the expenditure on capital account had risen to £538,000, and the gross receipts to £71,303, on which there was a gross profit of £25,488. Just before the war broke out the Company were paying a dividend; but the war had naturally interfered with their affairs, and thrown them out of gear. Coming to the Board of Trade report upon the Bill, which suggested that the Company should adopt the policy of applying to the Board of Trade for Provisional Orders for each individual district when desired, and which also pointed out that the Company did not intend to undertake any obligation to lay mains in the large number of districts proposed to be dealt with, Counsel said that here again the observations as to the obligations which the Company intended to take were perfectly true when applied to the Bill as deposited. Since then, however, the agreed clause with the local authorities and the county council had placed the Company in the position, should they obtain these powers, of an ordinary Provisional Order company supplying electricity for lighting. It was true, as pointed out in the Board of Trade report, that a Company called the Electrical Distribution of Yorkshire, Limited, was closely associated with this Company, and had applied for Provisional Orders for a large number of districts in the Power Company's area. The Company, however, could not agree with the Board of Trade that this policy should be continued, as Provisional Orders had already been granted for what might be called the cream of the district; and the areas remaining to be dealt with were so small that it would pay nobody individually to apply for Provisonal Orders. On the other hand, the Power Company had their mains running through most of them; and it would be a simple matter to afford a supply whenever it was desired. If clauses 12 and 13 of the Bill, as suggested by the Board of Trade, were withdrawn, the whole of the Bill might just as well go. Clauses 12 and 13 read as follows:

> 12.—(1) As from the passing of this Act, section 48 of the Act of 1901 shall be read and have effect as if at the end of sub-section (1) of that section the following words had been inserted: "(c) To persons (other than authorized undertakers) requiring a supply for lighting purposes in any of the districts or parts of districts specified in the fourth schedule to this Act;" and as if the words "except as aforesaid" had been inserted at the commencement of sub-section (2) of such section, and as if the first schedule to this Act had been annexed as the fourth schedule to the Act of 1901.
>
> (2) Sections 62 and 71 of the Act of 1901 shall be read and have effect as if the words "for power" had been omitted therefrom respectively.
>
> 13.—Notwithstanding anything done under the Act of 1901 the Company may charge for energy supplied for lighting purposes to persons other than authorized undertakers prices not exceeding those stated in the second schedule to this Act as if those prices had been authorized by the Act of 1901 and had been added to the second schedule to that Act.

Friday, April 23.

On the resumption of the proceedings this morning,

The CHAIRMAN asked if there was any case of a similar Bill to this having been promoted before.

Mr. FREEMAN said that in 1906 the Kent Electric Power Company, a bulk supply Company, obtained powers to supply electricity for lighting, and in the following year the North Metropolitan Electric Power Supply Company also obtained similar powers.

Mr. *A. G. Lupton*, the Chairman of the Yorkshire Electric Power Company, was the first witness. He said the Company had grown steadily from the commencement, and the first generating station had had to be supplemented by a further two. At the Baraugh power station, electricity was generated by means of coke-oven gas, which was available day and night, and which was previously going to waste. The other power stations were at Thornhill, near Dewsbury, and at Thorn, near Goole. The Directors, directly or indirectly, held 40 per cent. of the share capital. The Company had been formed as it was believed that a cheap supply of electric power was essential to the industries of the county. At present a supply was being given in bulk for distribution for lighting purposes under 23 Provisional Orders held by local authorities or companies. Nobody, however, was likely to take up Provisional Orders for the remaining districts, as they were either too small or too sparsely populated. The only prospect of a supply in the 64 districts included in the Bill was from the Power Company. All these local authorities were in favour of a supply. The people who now objected had nothing whatever to do with the supply. The local authorities who did not desire a supply had been cut out of the Bill; but the origin of the Bill was the large number of applications which the Company had received for a lighting supply. More than forty local authorities had passed resolutions in favour of the Bill, and the remainder of the 64 did not object. It was an unreasonable state of things that whereas one person using electricity for power could use practically all he wanted for lighting, the man next door, who only wanted a lighting supply, could not get it. Considerable colliery developments were also taking place in the area, and the miners' houses would have no chance of a lighting supply under present conditions. Yet the Power Company had mains running through the district. An extension of the Company's powers in the direction desired would be an important factor in reducing the smoke nuisance. At present the Company were supplying in bulk in 23 districts where Electric Lighting Orders had been obtained; and it was desired to deal with the remainder of the district not so much because of the revenue which it was hoped to obtain, but because it was felt that the objects of the Bill would be for the benefit of the district.

Mr. WEDDERBURN, in cross-examination for the gas companies, called attention to the fact that in the Board of Trade report it was recommended that the Company should apply for individual Provisional Orders for the districts. It was further pointed out in the report that the Company did not propose to place itself under the ordinary obligations of an electric lighting company.

Witness said the Board of Trade report was published upon the Bill as originally drafted. The report made certain objections; but amendments had been made in the Bill which the Company believed met these objections. A clause had been agreed with the local authorities and the West Riding County Council under which the Company would have to give a supply in the districts within five years or have their powers taken away by the Board of Trade.

Mr. WEDDERBURN: Have the Board issued any report approving the Bill since the modifications have been made?

Witness: So far as I know, they have not.

Mr. WEDDERBURN then went on to show that even the agreement with the local authorities and the West Riding County Council by no means brought the Company within the law relating to electric lighting. No compulsory area was scheduled for each particular district, and the Company were not bound to lay any mains at all. The only compulsion upon them was that a consumer could demand a supply if he was within 50 yards of a main. If he was not near a main, he could not compel the Company to lay one. If the Company did lay a main, they could insist upon a guarantee for seven years equal to 20 per cent. on the cost of laying it. The Board of Trade were perfectly right in saying that the general law was to be swept away by the Bill. Another important difference was that these electric lighting powers were being acquired in perpetuity; whereas if the Company proceeded by Provisional Order, the local authorities would have the right of purchase.

Witness said that the local authorities could force the Company to give a supply in five years.

Mr. WEDDERBURN said the local authorities could not buy the Company out; they could only push them out. He put it to witness that the two years limit ordinarily imposed within which the mains must be laid in the compulsory area did not apply, and none of the penalties usually applicable would be incurred.

Witness said an ordinary district dealt with by Provisional Order was not comparable with the districts covered by the Bill.

Mr. HONORATUS LLOYD, for the county boroughs, pointed out that several of these supplied gas in districts beyond their municipal boundaries, and the Company, under this Bill, would compete with the gas supply.

Witness admitted that it was the deliberate intention of the Company, when the Bill was drafted, to be free from any obligation to supply. The clause arranged with the local authorities did not bind the Company to give a supply. If the mains were in a particular district, a supply would be given; but there was nothing in the Bill to compel the Company to supply.

Mr. HONORATUS LLOYD: You are asking for an option?

Witness: Yes.

You are not proposing to give the Committee evidence as to the necessities of all these districts?—No.

Then the Committee will have no information to guide them in granting you this option?—We are prepared to give the Committee evidence that these districts want a supply.

Mr. HONORATUS LLOYD, in conclusion, referred to the Kent and North Metropolitan precedents mentioned by Mr. Freeman. The former, he said, were not opposed at all on principle, and the North Metropolitan were also unopposed, except by the Walthamstow Council, who asked to be excluded, and were excluded.

Mr. JEEVES, for the Brighouse Corporation, cross-examined on the point that there is at present a sub-station jointly owned by the Company and the Corporation which, under the Bill, could be made use of to facilitate the Company competing with the Corporation's gas supply in the districts outside Brighouse.

Witness: I do not think that the supply of electricity should be held back because of competition with gas.

Mr. *W. B. Woodhouse*, the Chief Engineer to the Company, referred to the anomaly of the powers now possessed. For instance, a colliery owner could put down his own electricity plant, and could light the cottages attached to the mine; but if the colliery owner took power from the Company, then he could not light the cottages. Instances of this kind had happened; and the same thing applied to mills. Reference was also made to cases where local authorities were supplied by the Company with energy for power purposes; but although it was desired that the Company should also light these districts, the Company could not do it. The Baraugh coke-oven gas station was being considerably increased, and the quantity of gas available would be much more. Two other stations, at Castleford and Doncaster, were being put down in connection with collieries; and coke-oven gas

would be used. In this way, the cost of generation would be much less than if small stations were erected in which coal was burned in the ordinary way. The only additional work to deal with lighting, compared with what was now necessary for power purposes, would be to lay the low-tension distributing mains. Thus the Company were in a much more advantageous position for dealing with the question than an independent company or local authority. Indeed, several Provisional Orders in the area had been allowed to lapse because the undertaking could not be made to pay as a small lighting concern; while, on the other hand, any power demand there might be could not be handled owing to the small size of such a generating station. In all these districts, it was the small houses which would benefit. The larger houses could always make use of the current for power purposes, and the lighting difficulty was overcome, as the current could then be used for lighting. He estimated that the area scheduled in the Bill could be supplied for an expenditure of £60,000. As to applying for Orders for each of the districts, the question of cost was an important matter. An Order usually cost £300, even if unopposed; while he had known Orders for quite small areas to cost £2000 if opposed. Furthermore, there was the unnecessary expense of keeping separate accounts. As to the purchase powers of local authorities, it would be impossible to give them this power owing to the difficulty of separating the Company's power business from its lighting business. A compulsory area in the case of Provisional Orders for these rural districts was not insisted upon by the Board of Trade. Except for this point and the compulsion to supply, the agreement with the local authorities met everything raised in the Board of Trade report. The present restriction upon the Company was equivalent to a gas company being allowed to supply for cooking and not for lighting. The number of gas companies opposing was only a few of the total. There were actually over 100 gas undertakings in the area; and it seemed that the few who were opposing were those charging the highest prices. The Sheffield Company, who supplied at the lowest price of all—viz., 1s. 3d. per 1000 cubic feet, and were, moreover, in competition with the Corporation electricity supply did not oppose. The opposition of the gas companies was with a desire to keep modern illumination from the inhabitants. In these small gas undertakings, the supply of gas was not very good; and they seemed to be fearful that everybody would use electricity. There was, however, plenty of room for both. The best example was London, where two of the most progressive gas companies in the country were working in an area in which there was much competition from electricity. The Yeadon and Guiseley Gas Company said that there was no need for a supply of electricity in their district: but the Power Company were negotiating for giving a supply to some works there. The price of gas was 2s. 6d. per 1000 cubic feet. With regard to the position at Brighouse, if the Company wanted to make further use of the sub-station, concerning which the agreement already mentioned exists, they would be willing to pay for it. On the other hand, the Brighouse Corporation wanted to prevent competition with their gas undertaking in the outside area; whereas inside Brighouse the municipal gas and electricity undertakings were at present in competition.

Mr. WEDDERBURN, in opening his cross-examination for the gas companies, said he wished first of all to make it clear that the 100 gas undertakings mentioned by Mr. Woodhouse comprised 56 companies; and although ten of these were opposing, opposition from others had been obviated because their areas had been cut out of the Bill.

Witness said this arose from the fact that the Company had taken out of the Bill the area of any local authorities which objected. In reply to questions as to the Company's obligations under the Bill, he contended that the substantial provisions of the electric lighting law had been embodied in it, or an equivalent had been put in. There was an obligation to give a supply under clause 27 of the Electric Lighting Clauses Act; while section 62 of the Company's Act of 1901 compelled them to give a supply on the basis of a seven years' guarantee of 20 per cent. of the cost of the necessary mains, if the premises were a greater distance than 50 yards from the mains, or a two years' guarantee if the distance was less than 50 yards. He agreed, however, that better terms would have to be offered if customers were to be obtained.

Monday, April 26.

Mr. *Woodhouse* was re-examined this morning by Mr. TYLDESLEY JONES, who dealt first with the cross-examination by Mr. Wedderburn for the gas companies. Witness said that the schedule to the Bill containing the names of the districts for which lighting powers were asked was modified before the expiry of the time for depositing petitions, and it was not altogether the fact that opposition by the gas companies was avoided by cutting out their districts. As to the point that by the Bill the Power Company would be under no obligation to supply, it was put to witness by Counsel that gas companies were in an even more favourable position. A gas company was not compelled to lay a single yard of main; and unless a consumer was within 25 yards of a main (compared with 50 yards in the case of electricity), and offered a guarantee of 20 per cent. on the cost of connecting-up for two years, he could not get a supply of gas. As to the argument of the gas companies that the Power Company were seeking a monopoly, it was the fact, said witness, that the gas companies at present had the monopoly of their districts for lighting, and wished to prevent the monopoly being interfered with. Similarly, the powers possessed by the gas companies were in perpetuity; so that there could be no complaint from this point of view.

A number of representative witnesses were then called from several of the districts in which the Company were proposing to give a lighting supply.

Mr. *Charles Atkinson*, the Clerk to the Otley Urban District Council, expressed the opinion that competition with the Gas Company would be a fine thing for the district. He did not suggest that the Otley Gas Company were not doing their duty, but there had been complaints and discussions in the Council, and he believed the public would like an alternative means of lighting and power.

In answer to Mr. WEDDERBURN, witness said that when the district had grown the Council hoped to be in a position to take over the lighting and power supply themselves.

Mr. WEDDERBURN: Do you know that what the Company have said here is to the effect that you can never buy them out?

Witness: I do not understand that.

If the Power Company are asking for a perpetual monopoly, would you be content with that?—I cannot admit your hypothesis, because section 49 of the Company's Act of 1901 gives local authorities the right to purchase.

Mr. WEDDERBURN said that section 48 gave the Power Company authority to supply to authorized distributors and to persons for power purposes, and section 49 safeguarded the rights of local authorities to apply for Electric Lighting Provisional Orders, and at the same time gave the right to purchase the portion of the Company's power undertaking used exclusively for the purposes of the particular district. The Company admitted that the whole of their undertaking was so connected-up that it would be difficult to say that any one part of it was used exclusively for any particular district.

Mr. FREEMAN, for the Power Company, said that section 49 would also apply to the new lighting powers.

Mr. WEDDERBURN referred to the Board of Trade report, which pointed out the absence of compulsory purchase powers.

The CHAIRMAN: I think this is such an important matter, and Counsel have such conflicting views upon it, that the Committee will request the Board of Trade to send an official witness to deal with their report and any questions arising out of it.

Mr. *H. Beaumont*, the Clerk to the Wakefield Rural District Council, Mr. *Jackson*, a draper, of Liversedge, and Mr. *John Green*, the Chairman of the Wortley Rural District Council, also gave evidence in support of the Bill; Mr. Jackson remarking that the gas supply given by the Brighouse Corporation in Clifton, where he lived, was by no means satisfactory.

Further evidence of this nature was not given, at the request of the Chairman.

Mr. *H. Booth*, of the Board of Trade, spoke with regard to the report of the Department, which was as follows:

> The Yorkshire Electric Power Company were authorized by the Yorkshire Electric Power Act, 1901, to supply energy in bulk to authorized distributors and to persons for power purposes, and for the lighting of premises supplied for power, in a large area comprising the greater part of the West Riding of York.
>
> The Board of Trade are aware that the Company have exercised their powers to a certain extent, but considerable portions of the area are still unsupplied; and the Board observe that, while the authorized capital of the Company is £2,000,000, less than £500,000 has been issued.
>
> By clause 12 of the Bill, the Company now seek power to supply energy for ordinary lighting purposes in 64 urban districts, thirteen rural districts, and parts of six other rural districts; but, though seeking the powers, they do not propose to incur any obligation to lay mains or to give a supply in any of these districts within a specified time, seeing that the provisions contained in the schedule to the Electric Lighting (Clauses) Act, 1899, relating to compulsory works and supply, are excluded from incorporation with their Act of 1901, and are not applied by the Bill.
>
> Were the powers sought by clause 12 granted, not only would the Company be under little or no obligation to exercise them, but they would have those powers in perpetuity, as the provisions of the Electric Lighting Act, 1888, for purchase of undertakings by local authorities, are, by the Company's Act of 1901, excluded from application to the Company or their undertaking, and the provisions contained in the schedule to the Electric Lighting (Clauses) Act, 1899, enabling the Board of Trade to revoke the powers, are excluded from incorporation.
>
> Further, it appears to the Board of Trade that many of the provisions of the Company's Act of 1901, which were devised to meet the case of a supply in bulk to authorized distributors and large power users, are not suitable to the case of supply to ordinary consumers for lighting purposes—*e.g.*, section 62, under which an authorized distributor or a power user is required to enter into a contract to take a supply of energy for seven years, of such an amount that the payment to be made therefor shall not be less than 20 per cent. per annum of the outlay incurred by the Company in making provision for the supply, and section 64, which requires the authorized distributor or power user to give twelve months' notice of intention to discontinue the supply.
>
> It appears to the Board that it is desirable that the ordinary distribution of energy for public and private purposes should form the subject of applications for Provisional Orders, under which procedure the necessities of particular districts can be fully considered and provision made for meeting them within a prescribed time.
>
> In this connection, the Board observe that for some years past it has been the practice of the Electrical Distribution of Yorkshire, Limited—a Company registered under the Companies Acts, and closely associated with, and understood to have been formed by, the promoters of the Bill—to apply for Provisional Orders in respect of districts in the promoters' area of supply, and to undertake the ordinary distribution of energy supplied to them in bulk by the promoters; and the Board see no reason why this procedure should be departed from.
>
> The Board accordingly suggest that clause 12 (amending the Act of 1901) and clause 13 (prices for energy supplied for lighting purposes) be omitted from the Bill.

The CHAIRMAN: The promoters have put it before the Committee that if we pass the Bill before us, local authorities would still have the power under clause 49 of the Company's Act of 1901 to buy the Company out.

Witness said that was a very different power to purchase under the Electric Lighting Acts. Under these, at the end of 42 years a local authority could purchase the undertaking of a company in its district on the terms laid down by Parliament in these Acts. Shortly, the terms were the then value of the plant in position, without consideration for profits or goodwill. Under section 49, the local authority would, in the first place, have to promote a Provisional Order if they

desired to purchase, and, secondly, there was nothing said in the Act as to the terms upon which purchase should take place. He regarded section 49 as entirely permissive. If, for instance, the Otley Council desired to buy the Yorkshire Power Company out of their district under section 49, they would certainly have to pay for loss of profits, having regard to the fact that the Company held their powers in perpetuity, and also for goodwill.

The CHAIRMAN: You think that by certain methods, which you consider, perhaps, rather objectionable, these corporations or local authorities could regain power?

Witness: I think they probably could.

I do not understand how this view of yours tallies with the Board of Trade report, which says that the Bill gives powers in perpetuity to the Yorkshire Electric Power Company?—Perhaps when they wrote that they were very busy. The main point on our mind was probably compulsory purchase, and section 49 of the Act of 1901 escaped attention.

This is an unusually critical report on a Bill by the Board of Trade, and the Committee would be glad to have any other points?—I do not think we desire to say anything more than is in the report.

In answer to Mr. WEDDERBURN, witness said he had seen the clause arranged by the Power Company with the local authorities and the West Riding County Council, by which the Board of Trade could revoke the Company's lighting powers; but he did not regard this as putting the slightest obligation upon the Company to do anything in regard to distribution in the whole of this large area.

Lord WEARDALE: And your principal criticism with regard to the implied terms of purchase under clause 49 rests upon the fact that, in case of purchase by a local authority, they would have to take into account goodwill and profit as distinguished from the usual power under the Electric Lighting Act?

Witness: Yes.

Mr. FREEMAN, on behalf of the promoters, put it to witness that a consumer was amply protected, as he could compel the Company to give a supply, upon certain terms as to guarantee, according to whether or not he was within 50 yards of a main.

Witness said he could not imagine any ordinary consumer who desired a supply for lighting getting it in this way. He would not think of giving a two years' or seven years' guarantee of 20 per cent. of the cost of the necessary main. The amount he might have to pay would be prohibitive. In a Provisional Order a compulsory area was laid down. As to the fact that so many of the local authorities supported the Bill, he did not think a good many of them quite realized what the Bill intended.

Mr. FREEMAN remarked that he did not know why witness should say that. Dealing with the terms of purchase under clause 49 of the Company's Act of 1901, he said that an arbitrator appointed by the Board of Trade would be quite free to impose any terms he thought the conditions warranted. If he thought fit, he could order a purchase to take place on the terms of the Electric Lighting Act.

Witness said it would be better to have the terms specified.

Mr. WEDDERBURN said that, under the general law, local authorities had an absolute right of purchase at the end of 42 years, whereas under clause 49 of the Company's Act of 1901 there was a possibility and not a right.

Witness pointed out that, in the opinion of the Board of Trade, the view of Parliament all along had been that the large power companies should only deal in bulk and for power purposes, and that distribution for lighting purposes should be left to Provisional Order procedure. In the view of the Board, any alteration of this policy would be against the public interest.

The Committee Room was then cleared. When the parties were readmitted,

The CHAIRMAN said: The Committee have decided that, so far as clauses 12, 13, and 13A are concerned, the Bill cannot proceed. [These clauses deal with the power to supply for lighting purposes; clause 13A being the agreed clause with the local authorities and the West Riding County Council.]

Mr. FREEMAN, after consultation with the promoters, said that the other clauses were comparatively so small that it was not felt justifiable to incur further expenditure on the Bill.

LEGAL INTELLIGENCE.

LIABILITY FOR MAINTAINING A WATER-METER BOX.

In a King's Bench Divisional Court of the High Court of Justice last Friday, Justices BAILHACHE and SHEARMAN had before them the case of *Mist v. Metropolitan Water Board and Others*. It was an appeal from a decision of Deputy-Judge Lush, at the Westminster County Court, nonsuiting the plaintiff on the ground that there was no evidence of negligence on the part of the defendants to be left to the Jury.

Mr. C. T. WILLIAMS appeared for the plaintiff; Mr. CLAVELL SALTER, K.C., and Mr. ROSS BROWN represented the Water Board; and Mr. BARRINGTON WARD appeared for the other defendants, Cream Milk, Limited.

Mr. WILLIAMS said the plaintiff, Mrs. Mary Mist, claimed damages from both defendants in respect of an accident and injuries resulting to her which happened on the 7th of November last in Latchmere Grove, Battersea, owing, as was alleged, to the defective and dangerous condition of the cover of a water-meter fixed in the pavement, having one edge projecting 3 or 4 inches above the level. Plaintiff caught her foot against the cover, and was thrown to the ground and injured. Cream Milk, Limited, were the occupiers of the premises with which the meter was connected. The question was one of evidence, and the Judge held that there was no evidence of this. Plaintiff's case was that there was something in the construction of the cover which caused it to get tilted up.

Mr. Justice BAILHACHE said he gathered that the County Court Judge thought there was nothing structurally wrong with the cover, and that it could not have been in the position in which it was unless some third person unconnected with either of the defendants had, in fact, been tampering with it. This being so, neither of the defendants were liable.

Mr. WILLIAMS agreed that something of this kind was in the Judge's mind. He thought his main ground of action was against the occupiers, because they were liable for the safe maintenance of the cover; but he said the case ought to be left to the Jury against both defendants. These were heavy things which were controlled by the turncocks of the Water Board, who had keys with which to lift them up and down. One of them might have inspected the meter on the day of the accident, and not put the cover down properly.

Mr. Justice BAILHACHE: If it was done by some mischievous person, would the occupier who was responsible for maintenance still be liable?

Mr. WILLIAMS submitted that the onus would be on the occupier to show that he had exercised due care.

Mr. CLAVELL SALTER said, so far as the Water Board were concerned, he was anxious to argue the question of liability, which was very important to them. He left it to the other defendants' Counsel to urge that there was no negligence. He submitted that the Judge's decision was quite right, having regard to the provisions of the Water-Works Clauses Act. Plaintiff showed no legal liability and no duty towards her on the part of the Board. The case was governed by the decision in *Batt v. Metropolitan Water Board*.*

Mr. BARRINGTON WARD submitted that there was no evidence of negligence against the occupiers, even though they were responsible for the proper maintenance of the cover.

Mr. Justice BAILHACHE said if he were to make a guess at the cause of the accident, he might say that one of the servants of the Board went to read the meter and did not close the trap properly. Even if the Board were not responsible for maintenance, as was clearly the case, they might be made liable for negligence if there was any evidence of it. But no case of this sort was made by plaintiff.

After further argument, their Lordships gave judgment.

Mr. Justice SHEARMAN, in delivering the judgment of the Court, said the evidence showed that the cover in question was a heavy thing, which could only be lifted by some hook or key inserted in a hole. There was abundant evidence that on the evening of the day in question it was left open, so as to protrude over the pavement and make it a nuisance and dangerous to persons using the footpath. Plaintiff sued both defendants because the name of the Water Board was on the cover. There was no evidence to show how the lid came in that position. The Judge said there was no evidence that either of the defendants was negligent or responsible for the accident; and plaintiff said there was evidence against both of them. It was well settled by authority that all the requisite and proper apparatus which was made for the supply of water to a house had to be maintained by the owner of the premises, because, whether or not it had been put in by him, it had been done at his expense; and, under the terms of the Statute, it must be taken that it was put in by him, and that he was entirely responsible for its maintenance. It practically came to this, that he had the control and responsibility for the pipes, the stopcock-box, the meter, and the meter-box. The Water Board therefore said that they had no responsibility for the trap; and that there could be no *primâ facie* inference drawn which they could be required to answer. He thought the Court were bound to accede to that argument. If the plaintiff did not give any evidence as to the person who was responsible for the maintenance of something attached to the house of which the lessor had control, she could not say there was a *primâ facie* case against the person whose name happened to be stamped on the apparatus. He thought, therefore, that the Water Board were entitled to be dismissed from the case, and that the point they took, that, in any case, there could be no evidence rendering them responsible, was a good one. Plaintiff had an opportunity, by interrogatories or by giving affirmative evidence, to show that there had been active interference with the apparatus by the turncock; but she did not raise such a case, or attempt to make it in Court. He thought, therefore, at the time the evidence was concluded, no case was made against the Water Board. As regarded the occupiers, the case was different. Here was something for which the legal control and responsibility were entirely with them. He thought *primâ facie* it was a case where some answer was called for from those responsible for maintaining the meter and keeping it in order. This case had to be tried; and the householders might have a perfectly adequate explanation, and show that the accident was through no fault of theirs. The County Court Judge struck too soon in saying there was no case against those responsible. The appeal must be dismissed with costs so far as the Water Board were concerned; and there would be a new trial against the other defendants.

* See "JOURNAL," Vol. CXV., p. 303.

Compensation for a Gas Explosion.

At the Belfast Recorder's Court, Judge Craig allowed Mary E. Morrissey, of Washington Street, compensation at the rate of 7s. a week for five weeks, and medical expenses, in respect of injuries sustained in a gas explosion in the house of her employer. Applicant said there was an escape of gas in a room where a stove was in use, and she went into the apartment with a light, whereupon the explosion occurred. She was severely burned about the head, neck, and face, and suffered from shock.

The Belfast Gas Poisoning Case.—In the case of John M'Mullan, who was found dead in his bedroom [*ante*, p. 227], a Belfast Coroner's Jury returned a verdict of "Death from coal-gas poisoning; the gas having escaped from a leakage due to wilful injury to a gas-pipe." There was no evidence to show how the injury was caused.

MISCELLANEOUS NEWS.

EXAMINATIONS IN "GAS SUPPLY."

The City and Guilds of London Question Paper.

In the "JOURNAL" last week, we gave (p. 217) the questions set by Mr. Samuel Glover, of St. Helens, the Examiner in the "Gas Engineering" examination held at the City and Guilds of London Institute on the 24th ult. We are now able to give the questions set by Mr. Walter Hole, of Leeds, in the "Gas Supply" examination held last Saturday. As on the previous occasion, the candidates were informed that not more than eight questions were to be attempted in the four hours allowed. The numbers at the ends of the questions are the maximum marks obtainable.

GRADE I.

1. If in searching for an escape of gas you find the socket of a 6-inch cast-iron pipe cracked, how would you (*a*) deal with it if, for any reason, permanent repairs could not be carried out for several days, and (*b*) deal with it permanently? [*34.*]

2. Describe the mechanism of registration of a dry gas-meter. State upon what constructional point accuracy of registration depends, and what precaution is taken in the construction to prevent fraud. [*38.*]

3. Is it desirable to govern the pressures upon a consumer's premises? If so, why? Describe and sketch any apparatus you would use for the purpose. [*38.*]

4. A dining-room 18 ft. by 16 ft. by 10 ft. is lighted by two inverted incandescent burners, each consuming 3½ cubic feet of 15-candle power gas per hour. What volume of air will be required per hour for the perfect combustion of the gas, and, assuming that the whole air of the room is renewed three times per hour, what percentage will the air for combustion be of the total passing through the room? [*42.*]

5. Sketch a section through a good street lantern, showing particularly how (*a*) the air necessary for the combustion of the gas enters, and (*b*) how the products of combustion escape. [*42.*]

6. Enumerate the causes of the blackening of an incandescent mantle, and state what remedy you would apply in each case. [*32.*]

7. What is the reason of the discoloration of whitewashed ceilings frequently noticed over a gas-burner? How would you prevent this occurring? [*32.*]

8. If on attending to a complaint of irregular working of a gas-engine you obtained a pressure chart on the inlet of the meter similar to that shown in fig. 1, what fault or faults would you suspect, and how would you proceed? [*38.*]

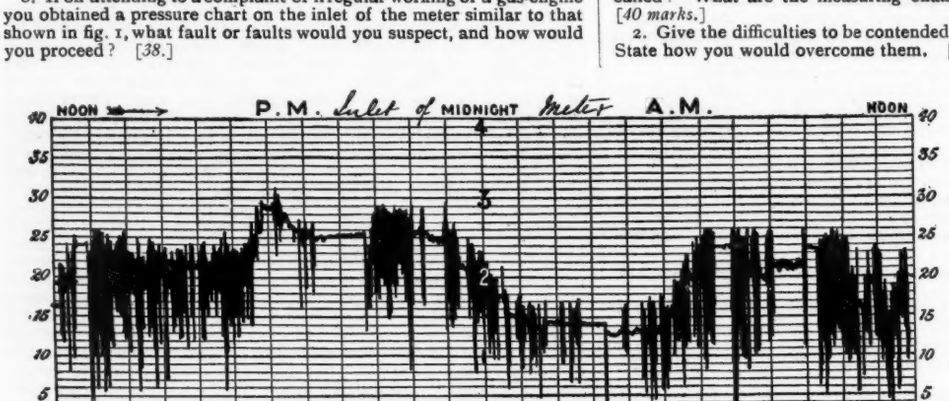


Fig. 1.—Question 8.

9. State, step by step, how you would proceed to make a tee joint on a ¾-inch compo pipe (½ in. into ¾ in.) What precautions would you take to ensure a satisfactory joint? [*36.*]

10. Fig. 2 shows a section through a well-known incandescent burner. State the use and purpose of each lettered part. [*32.*]

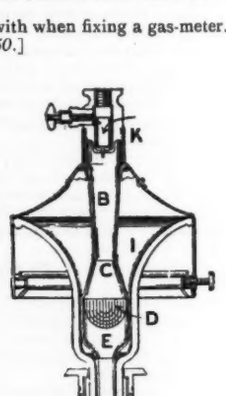


Fig. 2.—Question 10.

FINAL EXAMINATION.

1. A 10-inch main is supplying an out-district 2000 yards away, and is found to be delivering 5000 cubic feet of gas per hour. It is required to know how much additional gas the main will discharge when the initial pressure is 4 inches and the final pressure 3·2 inches head of water. There is no consumption along the line of main, but there is a gradual rise from the commencement to the end of the main equal to 40 feet. Solve the problem. ($Q = 1350\, d^2 \sqrt{\frac{p\ d}{s\ l}}$, and the specific gravity of the gas is 0·4, air = 1. [*38.*]

2. Describe, step by step, the best method you know of testing the radiant efficiency of a gas-fire. [*42.*]

3. Assuming a 90 per cent. efficiency in each case, calculate the daily cost for gas and electricity respectively of (*a*) a gas-heated hot-water supply, (*b*) an electrically heated hot-water supply, in which 100 gallons of water are heated per day from 40° Fahr. to 120° Fahr. when the gas has a net calorific value of 500 B.Th.U., and is 2s. per 1000 cubic feet and electricity is 3d. per unit. [*38.*]

4. Calculate and plot upon the piece of ruled paper given to you the half lower hemispherical polar curve of a high-pressure gas-lamp fixed at a height of 25 feet from the ground level to the centre of the mantle, which is found to give the following illuminating effects at ground level—viz.:

Immediately beneath the lamp	2·5 foot-candles.
At 20 feet from a vertical line passing through lamp	2·1 ,, ,,
At 40 feet ,, ,, ,, ,,	1·5 ,, ,,
,, 60 ,, ,, ,, ,, ,,	1·0 ,, candle.
,, 80 ,, ,, ,, ,, ,,	0·6 ,, ,,

To complete the curve, assume that the lamp gives 3500-candle power along the horizontal line passing through the centre of the mantles. It is assumed that the results at the ground level are obtained on surfaces perpendicular to the beam. [*42.*]

5. Discuss the relative advantages of (*a*) clockwork control and (*b*) pressure-wave control of public lighting. [*32.*]

6. Describe the mechanism and working of a four-phase gas-lit flashing sign. [*32.*]

7. Describe the manufacture of an inverted incandescent mantle, and state how you would test it for lighting efficiency and durability. [*32.*]

8. A gas-engine, when on full load test, is found to require 15 cubic feet of gas per indicated horse power. Calculate its thermal efficiency when the gas used has a net calorific value of 500 B.Th.U. What are the causes of irregular ignition, and how would you remedy them? [*34.*]

9. What is electrolysis? State how it is set up in gas-mains, and what steps you would adopt to minimize or prevent the evil when laying new mains. [*38.*]

10. Describe precisely the registration device of any high-pressure gas-meter with which you are acquainted, and state upon what constructional points accuracy of measurement depends. [*36.*]

EXAMINATIONS IN "GAS-FITTING."

The following were the questions put to candidates on Monday, April 26, at the first examination in "Gas-Fitting" held under the auspices of the City and Guilds of London Institute. The Examiners were Mr. H. Kendrick, of Stretford, and Mr. R. Halkett, of Glasgow. The candidates were directed not to attempt to answer more than six questions in the three hours allowed. The maximum number of marks obtainable is appended to each question.

GRADE I.

1. How many types of gas-meters are there, and why are they so called? What are the measuring chambers made of in each case? [*40 marks.*]

2. Give the difficulties to be contended with when fixing a gas-meter. State how you would overcome them. [*50.*]

3. Which do you prefer for gas-fitting—malleable wrought-iron pipe or barrel, lead pipe, or compo pipe? Give your reasons. [*40.*]

4. State step-by-step how you would proceed to make an upright joint and a tee-joint with two pieces of compo or lead pipe. What would be the effect on the flow of gas of a badly-made joint? [*50.*]

5. Give a list of the principal tools used by a gas-fitter. [*55.*]

6. Give a list of the various gas-burners in general use. [*40.*]

7. Give a general description of a first-grade cooker, describing all working parts. [*50.*]

8. Why is it necessary to fix gas and air adjusters on gas-heating appliances? [*45.*]

9. How is "gas pressure" usually stated, and what is meant by it? [*50.*]

GRADE II.

1. Describe the construction of a dry meter and a wet meter. State which you prefer, and give your reasons. [*50 marks.*]

2. Does the area of a pipe affect its delivery capacity? If so, how? [*40.*]

3. What effect has (*a*) a flat place in a lead pipe, (*b*) a bend, (*c*) an elbow, on the flow of gas through a pipe? Which has least effect, and why? [*50*]

4. It is found that the oven burners of a cooker go out; state the reasons for the defect, and how you would remedy it. What pressure is essential for the satisfactory working of a cooker. [*45.*]

5. Give sketches and describe the uses of the principal tools used by gas-fitters in their daily work. [*55.*]

6. Describe an adjustable inverted burner. What is the effect on the light obtainable of (*a*) an excess of air, (*b*) an insufficient supply of air? [*50.*]

7. When fixing a gas-fire, how would you determine when it was necessary to fix a flue-pipe, and the length required? [*45.*]
8. What is necessary to increase the temperature of a bunsen flame? [*50.*]
9. Why are chimneys used with "C" incandescent gas-burners. Do they cause an increase or diminution in the quantity of light given out? Give your reasons. [*45.*]

FINAL EXAMINATION.

1. How many burners would you allow to be supplied from a 20-feet length of each of the following sizes of pipe: ½-inch, ¾-inch, 1-inch, and 1½-inch.? Would you make any difference in the allowance for shops or private houses. If so, why? [*50 marks.*]
2. How would you test house pipes and fittings for soundness? Describe the apparatus you would use. [*60.*]
3. What effect has the colour of the gas-globes and walls of a room on the illumination? Place the following in order of least interference: Red, clear, opal, pale green, opalescent, frosted, etched. [*50*].
4. A consumer sends in a complaint of defective supply. How would you localize it and deal with it if it proved to be due to either a stoppage in the service-pipe or internal pipes, a defective meter, or defective burners? [*60.*]
5. Give a sketch of a high-power low-pressure outside lamp with which you are familiar, and state the utility of each part. [*45.*]
6. When fixing a gas-circulator to an existing hot-water installation, what precautions would you take to ensure satisfactory working? [*50.*]
7. Describe two systems of distance lighting for private houses. [*40.*]
8. Why is a gas-bag used on a gas-engine supply? Describe the working, and give a sketch of same. [*40.*]
9. What is convected heat and radiant heat? Explain the relative value of each. [*45.*]

BERLIN CORPORATION GAS UNDERTAKING.

Report for the Year 1913.

The report on the working of the Berlin Corporation gas undertaking during the twelve months ended March 31, 1914, has recently been issued, and from it the following particulars have been taken.

Efforts were made during the year to extend the use of gas for industrial purposes, and on July 1, 1913, a new scale of rebates to large consumers, and on gas consumed for certain special purposes, was introduced. The price of gas was fixed at 13 pfg. per cubic metre (3s. 8d. per 1000 cubic feet), and for gas sold through consumers' general supply meters rebates, ranging from 5 per cent. for annual consumptions not exceeding 175,000 cubic feet to 20 per cent. for annual consumptions exceeding 10,500,000 cubic feet, were granted. For gas sold through special meters, rebates were granted, irrespective of the quantity consumed, for gas used for passage and staircase lighting 15 per cent., and for gas used for motor or heating purposes or hot-water supplies 20 per cent. These concessions succeeded in extending considerably the consumption of gas for heating and industrial purposes. The number of ordinary meters in use increased by 7766 to a total of 296,886, and of prepayment meters by 18,414 to a total of 168,255; making a grand total of 465,141 meters of all classes.

The productions of gas at the various works was in the following proportions of the total: At the Gitschiner Strasse works, 16·1 per cent.; at the Danziger Strasse works, 34·3 per cent.; at the Schmargendorf works, 16·2 per cent.; at the Tegel works, 33·4 per cent. The total production during the twelve months was 333,544,000 cubic metres (about 11,780 million cubic feet), which was an increase of 4·1 per cent. on that for the preceding twelve months. Of the total, 89 per cent. was coal gas and 11 per cent. carburetted water gas. The total quantity of coal carbonized was 917,135 metric tons, of which 26·8 per cent. was German and the remainder English. The make of coal gas averaged 11,619 cubic feet per English ton, which is a slight increase on that of the previous year; and in the manufacture of water gas there were used on the average 46·4 lbs. of coke (exclusive of breeze for boiler fuel) and 9·2 lbs. of gas oil per 1000 cubic feet. The proportion of oil was considerably lower than in 1912, because less water gas was used; hence it was unnecessary to carburet it to the same extent in order to maintain the quality of the mixed gas. The consumption of coke in heating the retort-settings averaged 17 per cent. of the weight of coal carbonized.

The calorific power of the gas has been continuously checked by a recording calorimeter, and has been maintained at the average of 555 B.Th.U. per cubic foot (at 60° Fahr., 30 in., and saturated). The consumption of gas during the day time—*i.e.*, the hours when the public lamps are extinguished—was 42·5 per cent. of the total consumption, whereas it 1895 it was only 22 per cent. The gross production of coke and breeze amounted to 72·7 per cent. of the weight of coal carbonized, and the net amount available for sale—after deduction of the consumption in retort-furnaces, boilers, and water-gas generators—34·4 per cent. The yield of coal tar has averaged 4·3 per cent. by weight of the coal carbonized, and of water-gas tar 22·3 per cent by weight of the oil used. There were produced from the gas liquor 8972 metric tons of sulphate of ammonia and 495 tons of concentrated liquor. There were also sold in the year, 687 metric tons of retort scurf, 9112 tons of spent oxide, 775 tons of cyanogen sludge, and 6679 tons of clinker.

The gas produced at the Corporation works, together with that made by the Imperial Continental Gas Association, gives an average consumption in the year of very nearly 6500 cubic feet per head of the population. The gross profit on the year's working of the undertaking was 18,047,544 marks (about £884,683), and the net profit was 14,812,841 marks (about £726,120).

As part of the scheme of re-organization in connection with the Alliance and Dublin Consumers' Gas Company, it is proposed to appoint three lady canvassers.

NELSON GAS UNDERTAKING.

Mr. A. Morton Fyffe (whose appointment as Gas Engineer and Manager to the Blackburn Corporation was noticed in a recent issue) has just presented to the Gas Committee of the Nelson Corporation what will be his last report to them in the capacity of their Engineer and Manager. This deals with the year March 31, and contains the following figures with regard to the undertaking.

The expenditure on revenue account was £42,564, or £1300 less than estimated; while the income was £63,350, or £4505 less. The result was a gross profit of £20,785, and a net profit of £5299. Last year the gross profit was £22,573, and the net profit £7866. During the year 30,412 tons of coal were carbonized; and the total cost at the works was £21,660, which gave an average of 14s. 3d. per ton, as compared with 14s. 6½d. in the previous year, and 13s. 4d. two years ago. In the manufacture of carburetted water gas 15,816 gallons of oil and 60 tons of coke were used. The proportion of workmen employed in winter compared with those employed in summer now shows very little difference; and in future there should be an equal number all the year round. Before the introduction of vertical retorts, there was a difference between the number of summer and winter employees of about 50 per cent. The quantity of gas made was 415,541,000 cubic feet, of which 5,097,000 feet were carburetted water gas. The gross income from residuals and bye-products was £13,148; and after deducting all expenses of manufacture and handling of same, the net income was £11,232, giving a return of 7s. 4½d. per ton of coal, and making the net cost of coal 6s. 10½d. per ton delivered at the works, compared with 6s. 7½d. the previous year. The quantity of gas delivered last year was 415,943,000 cubic feet, being a decrease of 27,039,000 cubic feet, or 6·23 per cent. The consumption was in the following proportions: Ordinary meters, 48·9 per cent.; prepayment meters, 37·6 per cent.; street-lamps, 5·5 per cent.; gas-works, 1·9 per cent.; unaccounted for, 6·1 per cent. These figures include 163,900 cubic feet supplied free to houses occupied by Belgian refugees. There are now 14,948 consumers—8588 with prepayment meters. The number of cookers, boilers, and fires on simple hire is now 3943, as compared with 3996 the preceding year; but the decrease is more than compensated for by the purchase of appliances to replace those on hire from the department. The stove department dealt with 3105 appliances during the year. The capital outlay in the twelve months was: New works, £18,549; new mains, £2452; new meters, £1547. Notwithstanding the large expenditure on new works, and the extension of the business of the department, the capital had only increased by £8737 during the past five years.

As to the vertical retorts, Mr. Fyffe said that the new installation at Brierfield, put into operation on Jan. 9, had given completely satisfactory results. At the present time all the gas required was being manufactured by the new plant; the Nelson works being closed. The cost of the entire scheme was estimated at £26,000; and the work now completed had cost £25,335. All that remained was the erection of a coke-breaker, and the paving of the coke-yard. These two items would not cost more than the unexpended balance of £665; so the scheme would be completed without the estimated cost having been exceeded. The new sulphate of ammonia plant erected last summer was on the most modern lines; being known as the "semi-direct recovery process." The yield of ammonia had been increased, and the cost of manufacture reduced very considerably. During the year the high-pressure lighting mains were extended, and the business likely to accrue was considerable. The state of trade and the lighting restrictions had temporarily delayed the development of this very important branch of the undertaking.

The results of the year's working were, added Mr. Fyffe, entirely satisfactory, taking into account the abnormal conditions under which business had been carried on during the past winter. In spite of the increased cost of the necessary raw materials, the values of residuals and bye-products had been disappointing; while additional expense had been caused to the department by the irregular running of the cotton mills in the district during the autumn and early part of the winter, as it was necessary to have an excess of gas producing plant in constant readiness to meet the demand if, and when, a number of the mills restarted. No new plant would be required at either station during the next few years, as the works were now capable of a combined output of 3½ million cubic feet of gas per diem, while the present maximum daily demand did not exceed 2¼ million feet. The coming year must be viewed by all corporations owning gas-works as a very difficult one, requiring careful commercial management. Nelson was in ways more fortunate than many similar concerns, inasmuch as coal was bought during the past year at the old price, which would keep the supplies going till November, 1915; so that only one-third of the year's supply would require to be purchased at present prices, which were from 5s. to 6s. per ton more than last year's quotations. In the expenditure for the year 1915-16, it was estimated that coal would cost £2840 more, rates £1406 more, income-tax £900 more, and interest and sinking fund £1119 more; while repairs would cost £1317 less. The total expenditure was therefore estimated at £62,071, and the total income at £64,296; showing an estimated net profit of £2224.

Waterford Electricity Scheme.—At a Local Government Board inquiry into the Waterford Corporation's application for a loan of £30,000 for the purposes of an electric lighting scheme, a letter was read from Mr. A. D. Denny in opposition, on the grounds that the scheme was too ambitious for the city's requirements and resources and the amount of power which it was stated might be used by consumers—which he considered would be negligible. Judging of the way in which electric power plant had been availed of in Dublin and elsewhere, Mr. Denny believed the latter portion of the scheme would be a failure. He also held that the scheme had not the ratepayers' approval. Mr. Kent said the Corporation were paying £1900 a year for public lighting. Mr. J. Fleming (the Borough Surveyor) remarked that the charge for gas in Waterford was 3s. 4d. per 1000 cubic feet; but the gas supplied was unsatisfactory. He had not made any calculation as to the effect of an electricity scheme on the rates.

ROTHERHAM CORPORATION GAS DEPARTMENT.

Annual Report of the Engineer and General Manager.

Mr. J. S. Naylor, the Engineer and General Manager of the Rotherham Corporation Gas Department, has presented to the Gas Committee his report for the year ended the 31st of March. It furnishes the following particulars.

The quantity of coal carbonized was 27,050 tons, at a cost of £16,751, or 12s. 4·62d. per ton, compared with 27,385 tons, costing £17,179, or 12s. 6·55d. per ton in the year ended March 31, 1914—being a decrease of 335 tons and £428 respectively. The gas made was 352,930,000 cubic feet, against 349,180,000 before—being an increase of 3,751,000 cubic feet, or 1·07 per cent. Mr. Naylor says the make in the past year constitutes a record for the department. The make per ton of coal carbonized was 13,047 cubic feet, compared with 12,751 cubic feet in the year 1913-14, or 296 cubic feet more. The quantity of gas sold was 316,992,000 cubic feet, against 307,853,000 cubic feet—an increase of 9,139,000 cubic feet, or 2·97 per cent. The unaccounted-for gas was 32,904,000 cubic feet, or 9·28 per cent. of the make, compared with 38,421,000 cubic feet, or 10·95 per cent. before—a decrease of 1 67 per cent. The gas sent out during the year was kept of uniform illuminating power, and the impurities were kept low. The works and plant were maintained in good repair and thorough working order out of the year's revenue.

Dealing with financial matters, Mr. Naylor points out that the prices of residuals were considerably lower during the year, resulting in a decreased income of £1895 as compared with the year 1913-14. The gas for public lighting, including wages and maintenance of lamps, amounted to £4799, against £4784 before; and the cost of public lighting was £2760, against £2476—an increase of £284. It is explained that this was chiefly due to the longer lighting hours at the beginning of the war. The balance in the bank on the 31st of March was £1867, against £3518 at the corresponding period of 1914. The gross profit was £16,146, or a decrease of only £188, notwithstanding a reduced income of £1895 from residuals and the higher cost of materials and wages. The net profit, after allowing for interest, redemption instalments, and contribution to the sinking fund, amounted to £6600, a decrease of £146 compared with the year 1913-14. Mr. Naylor says that if the gas for public lighting (£2760) is again given by the department as in former years, there will remain an available profit of £3840, against £4270 this time last year.

STOKE-UPON-TRENT CORPORATION AS EMPLOYERS.

The Gas Managership—Employment of Members' Relatives.

At the Meeting of the Stoke-upon-Trent Town Council last Thursday, two matters bearing upon the position of the Corporation as employers—one relating to the appointment of a Chief Gas Engineer and Manager, and the other to the employment of relatives of members—were under discussion.

The Gas Committee reported that they had had under consideration the question of the management of the gas undertakings; and they recommended: "That an advertisement be issued for a Chief Engineer and Manager of the gas undertakings of the Corporation, at a commencing salary of £500, rising to £700 per annum, with coal and light free." It was agreed by the Council to delete the words "with coal and light free," and Mr. Townsend protested against the amount of the salary. He thought they paid gas managers salaries altogether in excess of their value. They must pay £500 to a man to make gas, but to a head teacher, whose task it was to make citizens, they rarely, if ever, paid £250. He moved, as an amendment, that the commencing figure be £400. Alderman J. H. Ball seconded this. Alderman Mitchell, the Chairman of the Gas Committee, pointed out that at Blackburn a salary of £800 was offered for duties less onerous than those attending the managership of the Stoke-upon-Trent gas undertakings. The amendment, however, was carried.

There was a long, and at times rather heated, discussion on the subject of the employment by the Corporation of relatives of members. The matter was introduced by Mr. Sampson Walker, who submitted the following motion: "That it be an instruction to the Chief Electrical Engineer that no further appointment of employees of the Electricity Department be made from among relatives of members of the Electric Supply Committee." He said there were six members of the Labour Party on the Committee, and he was given to understand that five of them had sons working for the Committee, and all holding positions of responsibility. He submitted that, in the interests of public opinion and the maintenance and preservation of the clean hands of the Corporation, which the Labour Party had always loudly advocated, this was not proper, nor was it fair to the Chief Electrical Engineer. It was contrary to the interests of the Council, the Chief Engineer, and public government.

The motion was seconded by Mr. Frank Collis, who stated that allegations had been circulated by the "man in the street" that mistakes in meter reading, amounting in one case to as much as £1000, had been made. He had been asked if he knew it was a fact that out of six members of the Labour Party on the Electricity Committee five had sons or other relations at the works; and he said he did not know, and refused to believe it. He refused to believe it of a party which had always prided itself on its morality in municipal government. If it were true, then he asked the members if they considered it fair to the General Manager of the undertakings that he should be surrounded by so many relatives. It was quite possible his hands would became so tied that he would falter about assuming the responsibility if anything went wrong.

Mr. Whittingham moved, as an amendment: "That it be an instruction to the Town Clerk that no further appointment of persons who have relatives on the Council should be made." This having been seconded, the Mayor (Alderman Philip Elliott) expressed the hope that the Council would not bind themselves rashly; and he threw it out, as a suggestion, that they should pass the following recommendation: "That it is undesirable for near relatives of members of the Council to be employed by Committees upon which such members are serving." Mr. Townsend said if the Council passed such a recommendation the whole discussion would end in smoke. It was purely a pious expression of opinion, and would not bind anybody. The Chairman of the Committee having offered some explanatory remarks, the amendment was carried by 30 votes to 29.

Mr. H. Coates expressed the opinion that the amendment, which had now become the substantive motion, was a little too drastic; and he moved: "That no member of this Council shall be competent to sit on any Committee where a relative is employed." Alderman Brookhouse pointed out that by adopting this proposal the Council might make it impossible for a man with special knowledge to serve on a particular Committee; and Mr. Whittingham argued that the amendment would not materially alter the present position. Mr. Noah Scott, on the other hand, thought it was the best possible suggestion for the solution of the problem. Eventually the amendment was carried. Mr. Lovatt asked if this meant that every member of a Committee having relatives employed by them must resign; and the Mayor replied in the affirmative. As a further amendment, the Deputy-Mayor (Alderman J. S. Goddard) moved: "That it is undesirable for near relatives of members of the Council to be employed by Committees upon which such members are serving." By adopting this, he said, they would leave the way open to do something further in the future if it was not sufficient. There was no seconder to this amendment; and upon Mr. Coates' amendment being put as a substantive motion it was declared to be carried.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

At a meeting of the Edinburgh and Leith Commissioners on Monday, a report by Mr. W. R. Herring, the Consulting Engineer, and Mr. Alex. Masterton, the Engineer and Manager, was submitted with regard to the tenders for coal. It was stated in the course of the report that the position of the coal market in Scotland is at present determined exclusively by the demand for export coal, and fancy prices are being asked and accepted for delivery over the current year. The position of the coal trade is so speculative that the reporters hesitate to advise the Commissioners to refrain entirely from purchasing some coal at the moment, as circumstances may develop to prevent them buying anything like the quantities required. They were therefore reluctantly compelled to put before the Commissioners a modified list, which will average an increased price of 9s. per ton over last year's rates for the same class of coal. Councillor Lindsay, the Convener of the Works Committee, in moving the adoption of the report, said they had made purchases of coal which would carry them well into next year; and he suggested that the management should be instructed to make further purchases as opportunity might arise. The report was adopted, and a Consultative Committee was appointed to deal with the situation in the event of any contractor failing to fulfil his part of the bargain.

The report for the month of March which Mr. Alex. Masterton, the Engineer and Manager to the Edinburgh and Leith Gas Commissioners, presented to the Works Committee of that body early last month, and was approved at the meeting on Monday, showed a remarkable increase in the number of cookers in use, grillers and boiling-rings on loan, and fires on hire, as compared with the corresponding month of 1914. The following are the figures for the two months: Cookers, 15,843 and 17,200; grillers and boiling rings, 7837 and 11,509; fires, 3888 and 6788. At the same meeting the report of the Treasurer and Collector (Mr. A. Canning Williams), showing the quantity and value of the gas sold during the winter term of 1914-15, as compared with the corresponding period of 1913-14, was submitted and approved. There was a general increase, with the notable exception of the public lighting in Edinburgh and Leith, which decreased to the extent of 12,030,400 cubic feet, or 48 36 per cent. But for this, there would have been an increase of about 5 million cubic feet in the total sales; whereas there was a net decrease of 7,192,900 cubic feet, or 1·03 per cent. on 1913-14.

The Buckhaven Town Council recently gave notice to the Leven and Methil Gas Company of their intention to acquire the Leven portion of the undertaking, and also the distributing plant in Methil. For some months the Council negotiated for the latter part of the undertaking only, but were advised that they could not treat for a portion. The Leven Town Council have decided, after learning the intentions of Buckhaven, to acquire the gas-works; but they cannot take the next step till the statutory procedure has been followed.

Year's Gas Sales at West Bromwich.—In a report issued on Saturday, the Gas Committee of the West Bromwich Corporation state that the sales of gas during the financial year ended March 31 were 396,894,584 cubic feet, including public lighting. This was an increase of 28,971,417 cubic feet as compared with the previous year. The amount of gas-rental was £44,198, an increase of £2506.

Proposed Museum for the Lighting Industry in Berlin.—In the "German News" in the "Ironmonger" for last Saturday, it is stated that Berlin proposes to add to its numerous collections a museum of illuminating appliances, in which the development of lamps and other devices for street lighting will be shown from the Seventeenth Century. The announcement of the proposal, in the "Berliner Tageblatt" for the 12th ult., concluded as follows: "Berlin has not only gradually overtaken, but even outstripped, Paris in this matter as in others. The capital of the German Empire is now the *Ville Lumière*. It was already the City of Light before the present war. It is so now, and it will be so more than ever after the war."

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 3.

The London market for tar products is quiet, with hardly any new feature to report. It is stated that a large quantity of ordinary London creosote has been sold at 4⅛d. net per gallon in bulk at makers' works. Naphthalene in various forms continues in large demand. Steamers for pitch are still very difficult to obtain, apart from the rates of freights being fearfully high.

The value of sulphate of ammonia for prompt is steady at £13 7s. 6d. per ton net and naked at producers' works for 25 per cent. quality. There is an increased inquiry for forward delivery up to June, 1916, at improving prices.

Tar Products in the Provinces.

May 3.

There is little alteration in the market for tar products. Pitch remains firm; but the difficulties of shipment are increasing somewhat. Benzols are steady, and fair prices are reported to have been paid. Solvent and heavy naphthas are in good demand, and high prices have been paid in all quarters. Creosote is quiet, and some sales are reported at low figures. Crude carbolic remains steady.

The average values of gas-works products during the past week were: Gas-works coal tar, 21s. 6d. to 25s. 6d. Pitch, East Coast, 21s. to 22s.; Norfolk, Suffolk, and Humber ports, 18s. to 19s. per ton; West Coast, 19s. to 20s. Manchester; 20s. to 20s. 6d. Liverpool; 23s. to 24s. Clyde. Benzol, 90 per cent., naked, North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Crude naphtha, in bulk, North, 5¼d. to 5¾d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3d. to 3⅛d. Heavy oils, in bulk, 3¼d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 4d. to 3s. 5d. Naphthalene, £8 to £16; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *May* 1.

The improvement in the demand experienced late last week has been maintained throughout the present week, and the tendency of prices has continued upwards. The volume of new business from foreign buyers has not been large, but middlemen have competed keenly for all available supplies. The closing quotations are £13 10s. per ton f.o.b. Hull, £13 11s. 3d. per ton f.o.b. Liverpool, and £13 15s. per ton f.o.b. Leith. There has again been a good inquiry in the forward position, and up to £13 12s. 6d. per ton f.o.b. at the principal ports has been paid for July-December delivery in equal monthly quantities.

Nitrate of Soda.

The tone of this market has remained strong, and the spot prices have now advanced to 13s. per cwt. for ordinary, and 13s. 3d. for refined quality.

Sulphate of Ammonia.

From another source it is reported that this market has remained steady throughout the past week, and there has been a little more inquiry at certain ports. Outside London, makes are quoted at £12 15s. to £12 17s. 6d.; Hull, £13 7s. 6d. to £13 10s.; Liverpool, £13 10s.; Middlesbrough, £13 10s.; Leith, £13 12s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

There is more ease in the coal trade, and, with coal thrown on the market through the stoppage of exports to Holland, some classes of coal are lower in price. In the steam coal trade, the dulness is felt, though on the whole the output is well taken up. Best Northumbrian steams are from 27s. to 27s. 6d. per ton f.o.b.; second-class steams are about 24s. per ton; and steam smalls are generally firm at 14s. 6d. to 16s. 6d. per ton f.o.b. There is now a better demand for coal for export to the North of Europe; but steamers are still somewhat scarce, and thus it is rather difficult to make forward sales except where concessions in price are made. In the gas coal trade, there is a steady prompt demand, but forward positions are occasionally weaker; so that, with the lack of tonnage, in some degree the prices are rather irregular. Best Durham gas coals are 23s. 6d. per ton f.o.b., and second-class gas coals are 22s. per ton; while for "Wear Specials" the price is not much altered at 25s. per ton. There are a few contracts (not for very large quantities) in the market for Swedish and Norwegian ports; but with the uncertainty as to ready steamers and some difficulty as to enemy-interferences on the voyages, there is not so strong an inclination to enter into further contracts, except at fairly high f.o.b. prices. The freights on coal are quiet; but the opening of navigation to the North may stiffen them. Meantime, the market is a little uncertain, and it is difficult to do much business. Coke is firm on the whole. As the production is now less, and the stocks have been reduced, gas coke seems to be a little firmer; good makes being quoted from 19s. to 20s. per ton f.o.b. in the Tyne, whence the exports seem relatively rather better.

The Supply of Toluol.—On the recommendation of Mr. W. Shadbolt (the Gas Manager), the Llandudno Urban District Council have unanimously decided to obtain immediately, at a cost of £200, a plant for the production of toluol. It was stated that the gas manufactured in the year ended on March 31 was 14,641,000 cubic feet more than in the previous year. Of this, 13,697,000 cubic feet were made since November, when the troops were first billeted in the town.

The "Main" Value.

THE "Main" value is good value. First-class workmanship, sensible design, excellence of material—these three combine in the production of "Main" Cookers and make them popular wherever used. Mains can fill your requirements satisfactorily.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Chelmsford Corporation Bill.

The Parliamentary Committee reported at last week's meeting of the Chelmsford Town Council that a clause was being added to Private Bills involving the raising of capital which, if inserted in the Corporation Gas Bill, would prevent the raising or borrowing of any money until the termination of the war, and for one year thereafter, for the purpose of purchasing the gas undertaking, except with the consent of the Treasury. The Town Clerk had been in negotiation with the Agents for the Company with a view to making arrangements whereby the Corporation should take over the undertaking in the ordinary course, receive the income therefrom, and pay the Company interest on the purchase-money remaining unpaid through the operation of the Treasury clause at the rate of 5 per cent. per annum, from three months from the date of the award of the Arbitrator until the Corporation obtained the consent of the Treasury to the borrowing of the purchase-money, or the Treasury clause was rendered inoperative. The Agents replied that the Company would be prepared to accept the suggestion in principle; and the Committee authorized a continuance of the negotiations. As the result of a subsequent conference, the matter was settled. The arbitration would take place in the ordinary course, the price to be paid to be settled, the Corporation to take over the undertaking and obtain the sanction of the Treasury to borrow the money, and, if this were not obtained, the Council were to continue to pay interest at the rate of 5 per cent. on the unpaid purchase-money. The Bill had been considered by a House of Commons Committee, and agreed to with one or two alterations in matters of detail.

South African Lighting Association, Limited.—The Directors have resolved to pay on the 26th inst. a final dividend of 4½ per cent. (less income-tax at 1s. 9½d. in the pound) for the half year ended Dec. 31 last. This dividend, together with the interim dividend of 3½ per cent. paid in October last, will make 8 per cent. for the year 1914 (less income-tax at 1s. 6½d. in the pound).

Gas Charges and Electricity.—At the last meeting of the Stepney Borough Council, it was reported that a communication had been received from the Gas Light and Coke Company, intimating that, from the date of recording the meter-indices for the March quarter, the price of gas in the Company's district north of the Thames would be increased from 2s. 8d. to 3s. per 1000 cubic feet—this notice not to apply to gas consumed in street-lamps. A subsequent letter intimated that the price of gas supplied to public lamps would, except where a fixed annual charge was made under contract, be increased from 2s. 2d. to 2s. 10d. per 1000 cubic feet. Mr. G. T. Legg asked the Chairman of the Works Committee whether he would approach the Lighting Committee, with a view to the more extended use of electricity for lighting the streets. He entered a strong protest against the 8d. increase. Mr. Barber (the Chairman of the Works Committee) replied that at the present time they could not use more electric light; but he would bring the matter before the next meeting of his Committee.

Increased Price at Horncastle.—Sharing the experience of larger centres, Horncastle has been forced to the necessity of an increased price for gas. It was intimated at the last meeting of the Council that, consequent upon having to pay 23s. 6d. per ton for coal this year, compared with 17s. in the preceding twelve months, there was no alternative but to advance the charge 5d. per 1000 cubic feet.

Leicester and Gas Coal Prices.—The Leicester Corporation, at their meeting last Tuesday, discussed coal prices—especially in relation to the cost of producing gas—and protested against the systematic exploitation of the public by the coal owners. A resolution was adopted urging the Government to take steps to put into operation the recommendations of the Departmental Coal Committee, and to assume the control and regulation of the coal industry.

Increased Gas Charges in Battersea.—It was reported at the last meeting of the Battersea Borough Council that the South Metropolitan Gas Company had allowed the Council a rebate of £201 in respect of the last quarter. The following increases in the price of gas to ordinary consumers, from the present quarter, had also been notified: Wandsworth, Wimbledon, and Epsom District Gas Company, from 1s. 9d. to 2s. 1d.; South Metropolitan Gas Company, from 2s. 4d. to 2s. 10d.; and the Gas Light and Coke Company, from 2s. 4d. to 2s. 10d. per 1000 cubic feet.

Southampton Gas Company.—The report of the Directors, to be presented at the meeting to-morrow, states that the sale of gas for the half year ended Dec. 31 shows an increase of 14,622,000 cubic feet, or 3·51 per cent., over the corresponding period of the previous year. The amount available for the dividend on the ordinary stock, after payment of debenture interest and other charges, is £21,780; and the Directors recommend that the maximum dividend of 5 per cent. per annum, amounting to £16,193 for the half year, be paid (less income-tax), leaving a balance of £5587 to be carried forward. Upwards of seventy of the employees are serving in His Majesty's Forces at home and abroad. Their places will be kept open for them; and the Directors have granted allowances to their dependants.

Porthcawl Gas Committee.—The Porthcawl Gas Committee appear to be making a bad beginning; for the election of a new Chairman revealed a decided lack of that harmony which is so desirable in the management of business undertakings. In the first place it was proposed that Mr. T. G. Jones should be elected to the position; the seconder remarking that, after the work Mr. Jones had done in the successful promotion of the Bill, and more recently in the successful purchase of the gas-works, it was only right that they should confer the honour upon him. He had given his time, energy, and money for the welfare of the town. An amendment was, however, carried that Mr. T. E. Deere be made Chairman of the Committee. Thereupon, Mr. Jones left the chamber, after remarking that if there was any lack of confidence in the work of the old Gas and Parliamentary Committee, who had done so much, it would be just as well if he left them to it. The example thus set by the old Chairman was then followed by both the mover and the seconder of the original resolution.

Kindly forward us YOUR enquiry to-day.

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MANCHESTER.

London Office:
165, Gresham House,
Old Broad St., E.C.

Todmorden Municipal Gas Undertaking.

Despite war difficulties, and the fact that the past year has been an unfavourable one for gas undertakings all over the country, the Todmorden Corporation Gas-Works have come out with quite a good record. The annual statement, presented last Wednesday night, shows that the coal and cannel used was 14,213 tons, and the gas made 169,837,000 cubic feet. The make per ton of coal carbonized was 11,949 cubic feet. During the year, and since war broke out, the Municipality have been selling coke at the moderate figure of 11s. 8d. per ton. The gross profit on the year is £6387, and, after making an allowance for the abolition of meter-rents and extensive capital expenditure, and granting the sum of £994 to cover the deficiency on the electricity undertaking, the net profit is left at £241. Owing to the war, the value of residuals decreased. Great benefit has been derived from the institution of a show-room in the municipal market hall; and the sale of gas cookers, boilers, fires, and geysers has reached an unprecedented figure. Owing to the Corporation's best customer for pitch having closed-down through the war, there is an unusually large quantity in stock, which has been appreciably written-down. The working balance carried forward is £2569, and, in addition to this, there is a reserve fund of £5000.

Mansfield Gas Undertaking.

Though the Mansfield Gas Committee have been able to promise £1500 in reduction of this year's rates, the Chairman (Mr. T. Smith) was careful to explain at the last meeting of the Corporation that this amount must not be taken to represent profits on the twelve months. It was due largely to the fact that the Committee had a reserve fund which had been accumulating in small sums for a number of years. They had had a trying time, he added, since Christmas last; and he intimated that at the next meeting of the Committee the question of an increase in the price of gas must be taken into consideration. Mr. Marriott desired to know if it was not possible to have from the Committee an estimate of receipts and expenditure, in the same way as had been provided by the Water Committee. He alluded also to a rumour that there was £2000 due in uncollected amounts for gas. The Chairman admitted that at the end of March there was about £2000 uncollected, but explained that £1000 came in within a few days after that time. Replying to other questions, he afforded the explanation that the Gas Committee had required during the year 4000 tons more coal than they had anticipated; and this had had to be bought at a much higher price—an increase likely to be continuous, and which enforced the necessity for raising the price charged to gas consumers.

Increased Price at Dorchester.—The Directors of the Dorchester Gas Company have increased the price of gas 4d. per 1000 cubic feet as from the commencement of the current quarter.

Gas Profits and Smoke.

In a letter to the "Manchester Guardian," Principal J. W. Graham protests against the decision of the Gas Committee to raise the price of gas 6d. per 1000 cubic feet to enable them to continue "the burden of the £50,000 contribution which the gas consumers now pay as an extra rate." He says: "We are, in fact, at a critical point in the history of Manchester. Such a favourable opportunity may never occur again. The war, with all its evils, has brought with it in many directions a better organization of the national resources, the stoppage of waste, and a new consciousness of the value of human beings in health. Now is the best chance we have had to stop the encouragement of dirt and gloom which our city fathers themselves give by putting an extra rate upon consumers of the one article which offers any extensive release from the sunlessness of our smoky skies. Gas for power and for cooking and heating, together with the accompanying production of a smokeless domestic solid fuel from the residue, and these two things alone, can at present turn Manchester into a clean city. The argument is plain. If the cost of coal exceeds the income at present prices, there is no surplus to hand over to the rates; and if even then some deficit occurs, it can be met safely and prudently by diminishing for the time the liberal sinking fund. Once accustom the Finance Committee to adjust the rates to the claims upon the rates, and we may hope that when the war is over and the price of coal falls again, they will have learnt to do without this inequitable and disastrous device, and be willing to levy the city's expenses equally all round, instead of punishing those who make no smoke by levying an extra 3d. rate upon them." The writer then proceeds to point out that, with coal so dear, gas would become extremely attractive to all users, if it could still be had at the present rate, and concludes by expressing the hope that "no city councillor still holds that a city selling gas to itself at monopoly prices which it can always adjust, needs any margin of profit, as if it were an ordinary business with outside customers." At a meeting of the Town Hall Committee of the Corporation last Wednesday, it was decided to recommend the City Council to substitute gas-stoves for coal-fires now in intermittent use in the town hall. [See *ante*, p. 278.]

Croydon Co-Partners and the Price of Gas.—The "Croydon Co-Partner" for April says: "The enormous increase in the freightage charges has so affected the price of our raw materials that it has been necessary to increase the price of gas from 2s. 6d. to 2s. 9d. per 1000 cubic feet. This additional 3d. means that the co-partnership bonus is automatically reduced to 2¼ per cent. But co-partners will, we are sure, not regret, in such a time as we are at present living in, having the opportunity of bearing their portion of the heavy expenses falling upon the Company during the next few months. To strive to do all that is possible for economical working will be their motto, that by their energies they will be contributing their share in hastening the time when the price of gas can be reduced."

THE "ZENITH" GAS HEATED BOILER

is a COMBINED HEATER and STORAGE TANK complete with AUTOMATIC GAS VALVE (Thermostat).

The "Zenith."

Unequalled for providing constant supplies of Hot Water by day or night.

Especially valuable for use in Barracks and Hospitals and temporary buildings devoted to the care of the sick and wounded.

Made in three sizes:—10, 20, and 40 gallons.

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ARDEN HILL & CO.,
ACME WORKS,
BIRMINGHAM.

Price of Gas at Pwllheli.—At a meeting of the Pwllheli Town Council, Mr. Albert Jones complained that the Gas Company had given notice of their intention to raise the price of gas for lighting purposes from 4s. 6d. to 5s. per 1000 cubic feet. He said he did not consider that the Company were justified in doing anything of the kind. It was unanimously resolved to make a representation to the Board of Trade on the subject.

Croydon Gas Company's Bonus Scheme.—The Directors, having regard to the increased cost of living, have decided that, during the war, a bonus shall be granted to workmen on the following scale: Employees earning not exceeding 18s., 1s. per week; over 18s. but not exceeding 30s., 3s.; exceeding 30s., 2s. On salaries not exceeding the rate of £150 per annum, before deduction for funds, &c., 5 per cent. will be paid. The bonus will not be allowed to an employee in any week in which time may be lost (except through illness certified by a doctor, or on leave granted by an official under whose control he works.

Lincoln Gas and Electricity Undertaking.—The Lincoln city rates for the ensuing year will show an increase of 5d. in the pound upon last year's total. The diminished profits from the gas undertaking account for half the amount; the Council receiving £3000 less than they did twelve months ago from this branch of municipal enterprise. There has, however, been an increased sum of £500 voted from the profits of the electricity service in reduction of local burdens. Alderman T. Wallis (the Chairman of the Finance Committee), in moving the adoption of the estimates at a special meeting of the Corporation last Tuesday, stated that it was satisfactory to be able to record that all the trading concerns were absolutely sound financially. The total outstanding debt of the Corporation at the close of the financial year was £726,417, of which £519,609 was in respect of trading undertakings which are reproductive.

No Rate Relief from Gas at Stalybridge.—In introducing the estimates for the current year at the last meeting of the Stalybridge Town Council, the Chairman of the Finance Committee (Mr. J. Storrs) expressed regret that the gas-works did not show a better result. He said it would be within the recollection of the Council that last year it was decided that for the future the Finance Department should not lay credit for anything from the gas-works until the amount they might stipulate had already been made. Two years ago the Gas Committee informed the Finance Committee that at the end of the year they would be able to hand over a certain sum of money; but the Finance Committee actually received £500 less. This £500 was still owing, and he was sorry to say that the result of the trading of the Gas Committee during the past twelve months had been a loss of £961; so that the Committee were owing the Finance Committee at the present time a sum of nearly £1600. "I do not know any previous Chairman of the Finance Committee," added Mr. Storrs, "who has ever been placed in the unfortunate position of having three years in succession in which there has been no relief of rates from the gas-works." The rates have been increased 3d. in the £ in the borough, and 2d. in the added area.

APPLICATIONS FOR LETTERS PATENT.

5812.—R. & J. Dempster, Limited, Beard, G. F. H., and Scott, J. W., "Operating disc or like valves." April 19.
5813.—Hall, I. & L., "Burning gas." April 19.
5829.—Mitchell, W., "Oil-gas burners." April 19.
5830.—Mitchell, W., "Oil-gas generators." April 19.
5854.—White, J., jun., and Canova, V., "Dry meters." April 19.
5876.—Ashcroft, E. A., "Production of toluene and like bodies (with bye-products) from other hydrocarbons." April 19.
5941.—Tilley, F. C., "Inverted burner." April 20.
5958.—Batt, W., "Bunsen burners." April 21.
5960.—Illingworth, A., and Garsed, E., "Carbonization of coal." April 21.
5977.—Simmance, J. F., "Calorimeters." April 21.
5984.—Ionides, A. C., jun., "Utilization of combustible gaseous mixtures." April 21.
6021.—Billington, W. J., "Gas-cocks." April 22.
6073.—Arres, J. M., "Portable cover for the taps of gas-stoves." April 23.
6106.—Rosenthal, R., "Igniting burners." April 23.
6109.—Marks, E. C. R., "Gasholders." A communication from the Maschinenfabrik Augsburg-Nürnberg Akt.-Ges. April 23.
6136.—M'Creath, H., "Tar-thinning apparatus." April 24.
6162.—Bancroft, F. J., and Hansford, J. B., "Conduits for gaseous fluid." April 24.
6165.—Terrace, J., "Retort-stoking machines." April 24.

There are two things in connection with lighting that must interest factory owners. They are as to what their manufacturing neighbours are doing in the matter of lighting their premises, and as to how the lighting can help them to do more business. The James Keith and Blackman Company, Limited, have a very attractive circular leaflet, which they specialize for each gas-supply district (printing upon the face the title and office address of the local gas undertaking), and on the front and back of which, in bold script diagonally placed, are these words "What your neighbours are doing in high-pressure gas lighting," and "How high-pressure gas can help you to do more business." On opening one fold of the circular, information is given which must make those envious who have not done as their high-pressure lighted neighbours have done, and must induce them to at once inquire into the magnificence of the light that has such material business advantages as an increase of factory output, an improvement of quality, a safeguard to the health of the workpeople, and a reduction of the lighting bills. Open another fold, and there are illustrations from photographs of factories lit with high-pressure gas, and packed with work of all kinds. The managements of gas undertakings should see the circular. It has already been largely approved and adopted by some of the leading progressive concerns.

Just look at this Slot Cooker.

NOT up with the times—but **a little in advance all the time**—that's our policy—and here's a **Slot Cooker** you ought to see before closing any contracts—you want to see the real thing—the pictur e gives you no idea of the many advantageous features we have incorporated in this—our latest model.

Built for business—not to be admired only—we would be glad of an introduction through the post—and a chance to talk business—don't forget to drop us a line.

THE "PRIMO."

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BATH HOUSE, 57-60, HOLBORN VIADUCT, E.C.
Australasian Agents:
MOLDEN & BUDDEN PTY., LTD.,
364a, Little Collins Street, Melbourne, Vic.,
And at Sydney, N.S.W.

Messrs. J. & W. B. Smith have, in consequence of the rise in the cost of living, decided to grant a bonus to each employee during the continuance of hostilities. A scale has been drawn up under which the amount of bonus payable ranges in different circumstances up to 3s. per week.

Messrs. Fletcher, Russell, and Co's new cooker pamphlet not only describes and illustrates their patent indestructible gas cooking-ranges, but also draws attention to numerous other equally useful appliances for cooking and heating. Some incontrovertible arguments are set forth to show the wisdom of adopting gas for cooking and heating.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business on the Stock Exchange last week was on the whole less abundant in point of volume, with a quiet and subdued tone which forbade any tendency to indulge in too adventurous a spirit, while being at the same time confident enough to guard against any attack of weakness. Such a disposition is often beneficial—giving no encouragement to speculation which might outstrip the bounds of moderation, and encouraging the investing public with money in their pockets to embrace the offers of the sound securities which present themselves from time to time. And this is illustrated by the demand for Treasury Bills, and by the conspicuous success of Colonial Government short-dated issues, which ensure to the subscriber that his capital will be paid to him intact and without any shrinkage. The closing of the Exchange on Saturday (as usual on May Day) helped to make business quieter. Among the stronger markets were those for securities of high-class Americans and oils. Breweries and distilleries naturally recoiled from the Chancellor of the Exchequer's temperance measure, though not without hope that its features will have changed a good bit before it gets on to the Statute Book. The Gas Market had a quiet time, but showed considerable firmness, prices recorded for bargains done varying for the better where they varied at all. In the Money Market, the position was quite easy.

Bargains done for cash during the week were as follows: On Monday, Gas Light preference 87¼, 87⅛, 87⅜, ditto debenture 69¼, 69⅛, Imperial Continental 83½, Primitiva 3⅛, ditto preference 4½, 4 5/16, South Metropolitan 94, ditto debenture 68, 68½. On Tuesday, Gas Light ordinary 88½, 88⅝, 89, ditto preference 87⅜, Primitiva preference 4 5/16, South Metropolitan 94, 94⅛, 94¼, 94⅜, 94½, ditto debenture 68, 68¼, South Suburban 100. On Wednesday, Alliance and Dublin 68½, 68⅜, Brentford debenture 91½, Commercial debenture 68, Gas Light ordinary 88¼, 88½, 89, ditto maximum 70, Primitiva 3 11/32, 3 5/16, South Metropolitan 94¼ 94½. On Thursday, Commercial 4 per cent. 95, Gas Light ordinary 89, ditto maximum 69½, 70, ditto preference 86⅜, 88, Primitiva 3⅛, 3½, South Metropolitan 93, 94½, South Suburban 100. On Friday, Gas Light maximum 69¼, 69⅜, ditto debenture 69, 69¼, Liverpool 102¼, San Paulo debenture 91, 91½.

Bank rate (fixed Aug. 8), 5 per cent.; last year, 3 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING MAY 1.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p c.			£ s. d.	
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59 -64	3 18 2	68½—67⅜
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	
280,000	5	April 29	7½	Bombay, Ltd.	5⅛—6⅜	5 17 8	..
50,000	10	Feb. 26	16	Bournemouth Gas and Water { 10 p.c. B 7 p.c.	29—30	5 6 8	
273,480	10	,,	7		15—15½	4 10 4	..
95,000	10	,,	6	Pref. 6 p.c. Deb.	13⅜—14	4 5 9	..
—	—	—	—		..	—	
880,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	11	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	91½
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	..
630,000	20	Mar. 26	12½	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	
137,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	95
560,000	,,	,,	5½	Do. 3½ p.c. do.	103 - 105	5 1 6	..
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	68
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17½—18	5 11 1	..
16,282,910	Stk.	Feb. 12	4/17/4	Gas Light and Coke { 4 p.c. Ord.	98—102	4 15 6	88½—89
2,500,000	,,	,,	3½	3½ p.c. max.	76—79	4 8 7	69½—70
4,032,235	,,	,,	4	4 p.c. Con. Pref	96—99	4 0 10	86½—88
4,074,850	,,	June 11	3	3 p.c. Con. Deb	72½—74½	4 0 6	69—69½
130,000	,,	,,	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd	16½—16¾	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7½†	Ilford A and C	151—154	5 2 4	..
65,750	,,	,,	6½†	Do. B	115—118	5 8 0	..
66,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	83½
1,335,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
300,942	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7	..
561,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. { A / B	211—213 / 146—148	4 13 11 / 4 14 7	102½
718,100	,,	,,	7				
306,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	4½ -4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	99 -101	4 9 1	..
541,930	20	May 28	4	Monte Video, Ltd.	11⅛—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con	9⅜—9½	4 10 6	..
529,705	Stk.	June 26	3½	Do 3½ p.c. Deb	82—83	4 4 10	..
55,940	10	Feb. 26	7/14 0	North Middlesex 7 p.c	14—15	5 2 6	..
300.000	Stk.	May 14	8	Oriental, Ltd.	117 -122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd.	7⅛ -7⅜	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B	123—13.	4 19 2	..
100,000	5	,,	12	Do. C	118—121	4 19 2	..
52,000	50	,,	10	Do. D	..	—	..
249,980	5	April 29	5	Primitiva Ord.	5⅛—6	6 18 4	2 5/16—3 2/16
499,960	5	June 26	5	,, 5 p.c. Pref.	4⅛—5	5 0 0	4 5/16—4 7/16
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo { 6 p.c. Pref	10⅛—11	5 9 1	..
125,000	50	July 1	5	5 p.c. Deb	47—49	5 2 0	91—91½
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	Do. C	220—222	4 10 1	..
90,000	1	May 28	9	South African	10⅛—11⅛	7 16 6	..
6,429,896	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord	111—113	4 16 8	93—94½
1,895,445	,,	July 10	8	Do. 3 p.c. Deb	72⅜—74½	4 0 6	68 - 68½
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 2	100
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham { A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6†	B 3½ p.c. District { 4 p.c. Deb	115—117	5 2 7	..
181,255	,,	June 26	4		87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109,	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	Wandsworth A 5 p.c	151—156	5 7 4	..
255,636	,,	,,	6⅜	,, B 3½ p.c	129—134	5 2 7	
108,075	,,	,,	5/17/8	,, C 3½ p.c	110—115	5 9 0	..
354,000	,,	,,	6⅜	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅜	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

LADY (CHARGE OF SHOW-ROOM, &c.). Stretford Gas Company. Applications by May 15.

CHIEF GAS ENGINEER AND MANAGER. Stoke-on-Trent Corporation. Under consideration.

ENGINEER. Kristiania Gas-Works.

ENGINEER, MANAGER, AND SECRETARY. Tawe Valley Gas Company. Applications by May 15.

GAS-WORKS SUPERINTENDENT. Accrington Gas and Water Board. Applications by May 12.

WORKS SUPERINTENDENT. No. 6030.

ASSISTANT MANAGER AND BOOK-KEEPER. Yeovil Gas-Works.

DRAUGHTSMAN. Huddersfield Gas Department. Applications by May 8.

CANVASSERS. No. 254, Smith's Advertising Agency.

LEADBURNER (FOR INDIA). No. 6029.

FOREMAN. No. 6028.

RETORT-HOUSE FOREMAN. Stretford Gas Company.

GAS-FITTER. Dorking Gas-Works.

FITTER. No. 6034.

STOKER. Silloth Gas-Works.

STOKERS. Tiverton Gas-Works.

BLACKSMITH. No. 6034.

Appointments Wanted.

CLERK, &c. No. 6031.

COMMERCIAL, FINANCIAL, AND SECRETARIAL. No. 6032.

Gas-Works for Sale.

THREE MILLION FEET WORKS. No. 6022.

Plant, &c. (Second Hand), for Sale.

AMMONIA DISTILLATION PLANT. No. 6027.

"D.B." CHARGER. Hamilton Gas-Works.

PURIFIERS, &c. Rothwell Gas Company.

Plant, &c. (Second Hand), Wanted.

AMMONIA STILL. No. 6033.

Sales of Stocks and Shares.

LEA BRIDGE GAS COMPANY. London Mart. May 18.

SLOUGH GAS COMPANY. By Tender. May 13.

SOUTH ESSEX WATER COMPANY. London Mart. May 11.

TENDERS FOR

Benzol and Benzolized Creosote.

WALSALL CORPORATION. Tenders by May 17.

Coal.

BARROW-IN-FURNESS CORPORATION. Tenders by May 18.

BELFAST GAS DEPARTMENT. Tenders by May 13.

BILSTON GAS COMPANY. Tenders by May 12.

BRIDGNORTH GAS DEPARTMENT. Tenders by May 14.

CONGLETON GAS DEPARTMENT. Tenders by May 12.

DARWEN GAS DEPARTMENT. Tenders by May 22.

DROITWICH GAS DEPARTMENT. Tenders by May 13.

GOSPORT GAS COMPANY. Tenders by May 10.

LIMERICK GAS DEPARTMENT. Tenders by May 24.

LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by May 15.

OLDBURY GAS DEPARTMENT. Tenders by May 15.

PLYMOUTH GAS DEPARTMENT. Tenders by May 15.

STRETFORD GAS COMPANY. Tenders by May 20.

WESTON-SUPER-MARE GAS COMPANY. Tenders by May 11.

WORKINGTON GAS DEPARTMENT. Tenders by May 17.

Stoking Machinery and Coal Handling Plant.

HINDLEY GAS DEPARTMENT. Tenders by May 24.

Tar.

SALISBURY GAS DEPARTMENT.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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The One Machine which Discharges and Charges at One Stroke.
See Advertisement, March 23, p. 765.
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See Illustrated Advertisement, Feb. 16, p. 364.

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SPECIAL NOTICE.

COUNTY BOROUGH OF STOKE-ON-TRENT.

APPOINTMENT OF CHIEF GAS ENGINEER AND MANAGER.

THE Appointment for which Applications have already been invited is under further Consideration by the Council.

E. B. SHARPLEY,
Town Clerk.

Town Hall, Stoke-on-Trent,
April 29, 1915.

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